



# Project Controls EXPO

18th November 2014

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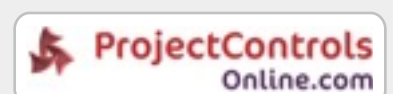
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# Key Features/Attractions

Partner Showcase and Main Networking zone at Highbury Suite, 2 Masterclass Zones @ Royal Oak Suite & Dial Square Suite and 1 Technical Zone @ Champions Suite. In addition to this, delegates can also explore "networking cafe" at 49ers Suite. There is also an opportunity for delegates to buy 70+ Project Management/ Controls title books at 40% discounted rates.

Expo 2014 also offers all day beverages, buffet lunch and "evening social" (includes beer, wine and soft drinks) to all delegates followed by dinner for sponsors, speakers and selected guests.

Industries represented – Oil & Gas, Construction, Rails, Infrastructure, Defence, Nuclear and Government to name a few.

## Location

**Emirates Arsenal Stadium/ Football Club, 75 Drayton Park, London N5 1BU**

Parking at the stadium is NOT available so please park at nearby car parks

(Link to find the nearby car parks: [http://en.parkopedia.co.uk/parking/n5\\_1bu/](http://en.parkopedia.co.uk/parking/n5_1bu/) )

## Directions

Getting to Emirates Stadium is simple; London's comprehensive public transport system will take you here within a few minutes' walk from local bus stops and tube stations, thanks to clearly located pedestrian signs pointing towards the stadium.

### **Tube and Rail (Preferred option):**

Both Arsenal and Holloway Road Stations (Piccadilly Line) are around three minutes walk from the ground. Finsbury Park (Victoria / Piccadilly Lines and overground rail) and Highbury & Islington (Victoria Line, North London Line, overground rail) stations are around 10 minutes walk from Emirates Stadium.

*We recommend "Holloway Road Station (Piccadilly Line)" considering it is nearest to "West stand" where the event is taking place. Please see map for more clear guidance. After you get out of Holloway road station, turn right and immediately turn left at signal crossing. You will see "Arsenal football club" signposting at this crossing junction. This brings you at "Hornsey road". Keep walking on Hornsey road for 100 yards and Arsenal stadium's west entrance will be just in front of you. Just climb the stairs that leads to expo reception.*

### **Bus:**

Buses are fast and convenient with connections passing the ground on all sides. Main bus stops are located on Holloway Road, Nag's Head, Seven Sisters Road, Blackstock Road and Highbury Corner. Direct, high frequency services from much of north and central London travel within five minutes walk of the ground.

### **Air:**

For our international visitors, nearest airport is London Heathrow which is well connected via extensive rail connections from Paddington (16 mins by train from Heathrow).

### **Walking:**

Local pedestrian routes are clearly signposted from all local transport gateways directing you along approved routes to the stadium. Upon reaching the stadium, please approach Highbury West Entrance between turnstiles A & S.

**Important note:** Upon reaching the Emirates Stadium (via options listed above), please head towards the West entrance of the stadium as shown in map below. The west stand faces Hornsey Road. Upon reaching there, you will be required to climb stairs to head towards "Highbury". At the Ground floor of Highbury, there is small reception desk with the main on Level 1. There are stairs and escalators to access Level 1.

Project Controls Expo  
@ Highbury Suite  
(West Entrance)



## Logistics Instructions for Exhibitors

Exhibitors can set up their stands one night before i.e., on 17th Nov 2014 from 1800hrs - 2100hrs. They can also send the courier with their items to the stadium (address below) up to 2 days in advance and also can pick up their exhibits up to 1 day post event from the stadium.

### Address for sending deliveries:

AFC Logistics  
Security Entrance, Emirates Stadium  
Queensland Road  
London  
N7 7AJ

Important Note - All vehicles need to access the stadium by the Queensland Road entrance (see map above). They will be checked in by Security who will then send them round to the Yellow 1 car park, where a steward will show them the nearest service lift and into the Highbury suite. Deliveries need to be clearly marked with the event name/function room (i.e., Project Controls Expo/Highbury Suite), and they need to go to the stadium address and not the Drayton Park address which is the Arsenal office address. Any deliveries during the set up and on the day will be sent directly round and a steward will show up to the room.

Please ensure that all deliveries are clearly marked with the Company name, function suite i.e., Highbury and date of the event (18 Nov 2014). All packages that are due to be collected should be left in the room post event and clearly marked with a contact name, return address and contact number. These packages will then be held in Stadium's secure storage until they are collected. Please ask all couriers to deliver/pick up between business hours 9.00-17.00. Due to a limited amount of storage, any packages that have not been collected within 28 days of the final day of your event will be at risk of being discarded.

There is limited parking available in the stadium, but exhibitors are welcome to drive in to drop off/collect. Project Controls Expo management will require the driver name and vehicle registration of any car driving in to the stadium. Pedestrian entry is the Highbury West Entrance between turnstiles A & S.

Exhibitors arriving by public transport or foot can enter at the Highbury West Entrance between turnstiles A/S on both days (17 Nov - between 1800-2100 hrs and 18 Nov - Before 0800 hrs) for setting up their exhibit.

# Accommodation

There are plenty of accommodation options around Arsenal stadium. For your convenience, please see below the contact details of some of the hotels situated locally who will be glad to offer you corporate rates to attend the event. While booking, please state the name and date of the event along with location i.e., Emirates Stadium:

**St Pancras Renaissance** - Ed White: +44 (0) 7900135964 / Edward.white@renaissancehotels.com

**Hilton Islington** - Stefanie Hardy : stefanie.hardy@hilton.com

**Double Tree by Hilton** - Abishesh Poudel : +44 (0) 207 282 5319 / Abhishesh\_Poudel@dtislington.com

**Pullman London St Pancras** - Yasmin Keen : +44 (0) 7785541956 / yasmin.keen@accor.com

## Internet access/ Wi-Fi

Project Controls Expo is pleased to offer complimentary WIFI Internet access to all the delegates of Expo. The network would be "Events" and password to gain access is "ProjectControlsExpo"

## Meals and Beverages

Expo 2014 offers complementary all day beverages, buffet lunch and "evening social" (includes beer, wine and soft drinks) to all delegates followed by dinner for sponsors, speakers and selected guests.

**Beverages includes:** tea, coffee, still and sparkling water in addition to cookies and brownies

### Lunch includes following:

Duo of humous and breadsticks (V)	Char-grilled chicken breast strips with a tomato and lime salsa
Home-made cheese straws (V)	Grilled steak served in flat bread with horseradish onions
Tomato and mozzarella brochettes (V)	Thai salmon fish cakes with a sweet chilli dip
Spinach and thyme risotto balls with a chive dip (V)	Fresh fruit skewers with a berry coulis (V)
Fruit flapjacks (V)	

**Evening social includes:** On the house selected Beer, Wines and soft drinks

**Dinner includes the following** (applicable to pre-invited guests only):

#### Starter options

West country cured smoked salmon, pickled beetroot salad, horseradish dressing

Roasted butternut squash soup garnished with parmesan and soft herbs (V)

Chicken caesar salad with crispy bacon, little gem, foccacia croutons and a parmesan dressing

#### Mains options

Braised shank of Welsh lamb with a grain mustard mashed potato, honey glazed root vegetables and a rosemary jus

Marinated supreme of corn fed chicken with a braised fondant potato, button onion and mushrooms and a red wine sauce

Tomato, basil and mozzarella filled gnocchi with a red pepper coulis topped with baby cress and pesto (V)

#### Dessert options

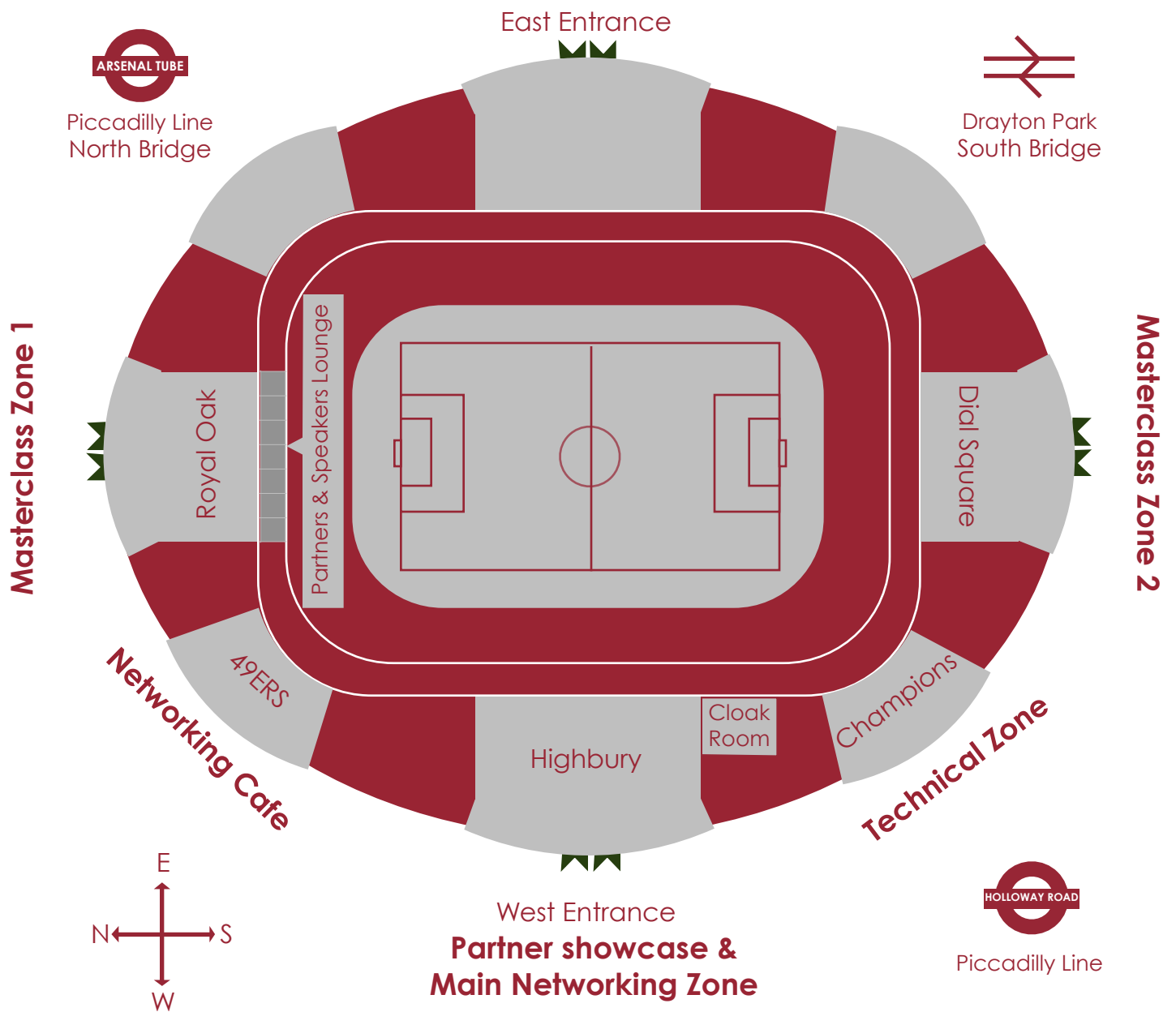
Warm chocolate fondant with a vanilla pod ice cream and a rich chocolate sauce

Emirates eton mess with marinated strawberries, crushed meringue, honeycomb and a strawberries ice cream

Chocolate and pear tart with a white chocolate sauce

**Important note** - If you have any special dietary requirements, please consult our support team or stewards for additional info.

# Overall Expo Layout (Bird's eye view)



Partner Showcase & Main Networking Zone @ Highbury Suite

Masterclass Zone 1 @ Royal Oak Suite

MasterClass Zone 2 @ Dial Square Suite

Technical Zone @ Champions Suite

Networking Cafe @ 49ers Suite

Quite Zones\* are located at "Galleries" of Royal Oak Suite and Dial Square Suite.

Access to Partner and Speaker lounge is by invitation only.

**Partners Lounge:**

- 27 - Conject
- 36 - RPC
- 39 - Program Framework
- 44 - Oracle Corp.

- 46 - Deltek
- 49 - Ares Corp.
- 50 - Ecosys

**Speakers Lounge:**

- 22, 24, 25 & 26



# \*Quiet Zones

Quiet Zones offers you peaceful area with comfortable seating. Please keep your phones switched off or in "silent mode" to ensure you don't disturb others. You can also access/view all the presentations from Quiet Zones if you wish to do so.

Please note considering the size of the event, Expo is spread across the 3/4th of the stadium so please make yourself fully aware of all the zones and plan your sessions accordingly. There is plenty of seating capacity (circa 250) in each zone to ensure you don't miss any presentation if you get late due to travelling between various zones.

For your convenience, below is some guidance on walking time between various zones:

Highbury to Royal Oak: circa 20 seconds

Highbury to Dial Square: circa 20 seconds

Highbury to 49ers: circa 10 seconds

Highbury to Champions: circa 10 seconds

Dial Square to Royal Oak: circa 35 seconds

## Social

Join us in the evening for a complimentary drink at our networking social.

To ensure delegates have least problems with navigation, there is significant signage at venue and in addition to that we have our crew/stewards who can help you move across the stadium efficiently.

## And relax!

After an intense day of learning come and join organisers, delegates and leading Project Controls Expo Partners for some uninterrupted networking. Reacquaint yourself with old friends and make new contacts whilst enjoying a few drinks.





# Event snapshot and Layout

Three parallel tracks showcasing 21 educational presentations, workshops and case studies in addition to Partner Showcase and Job Fair

## Partner Showcase & Job Fair

Up to 47 Exhibitors showcasing cutting edge products/ services along with Recruiters/ Employers presenting Global Project Controls roles/ Opportunities.

@ Highbury Suite

## Master class Zone 1

Study and discuss the theory and practice of Project Controls with leading Project Controls professionals from around the world in seven educational presentations and build/ enhance your project controls knowledge/ skills.

@ Royal Oak Suite

## Master Class Zone 2

Two workshops, two case studies and three education centric presentations offered by respected, experienced and senior Project controls professionals from Industry.

@ Dial Square Suite

## Technical Zone

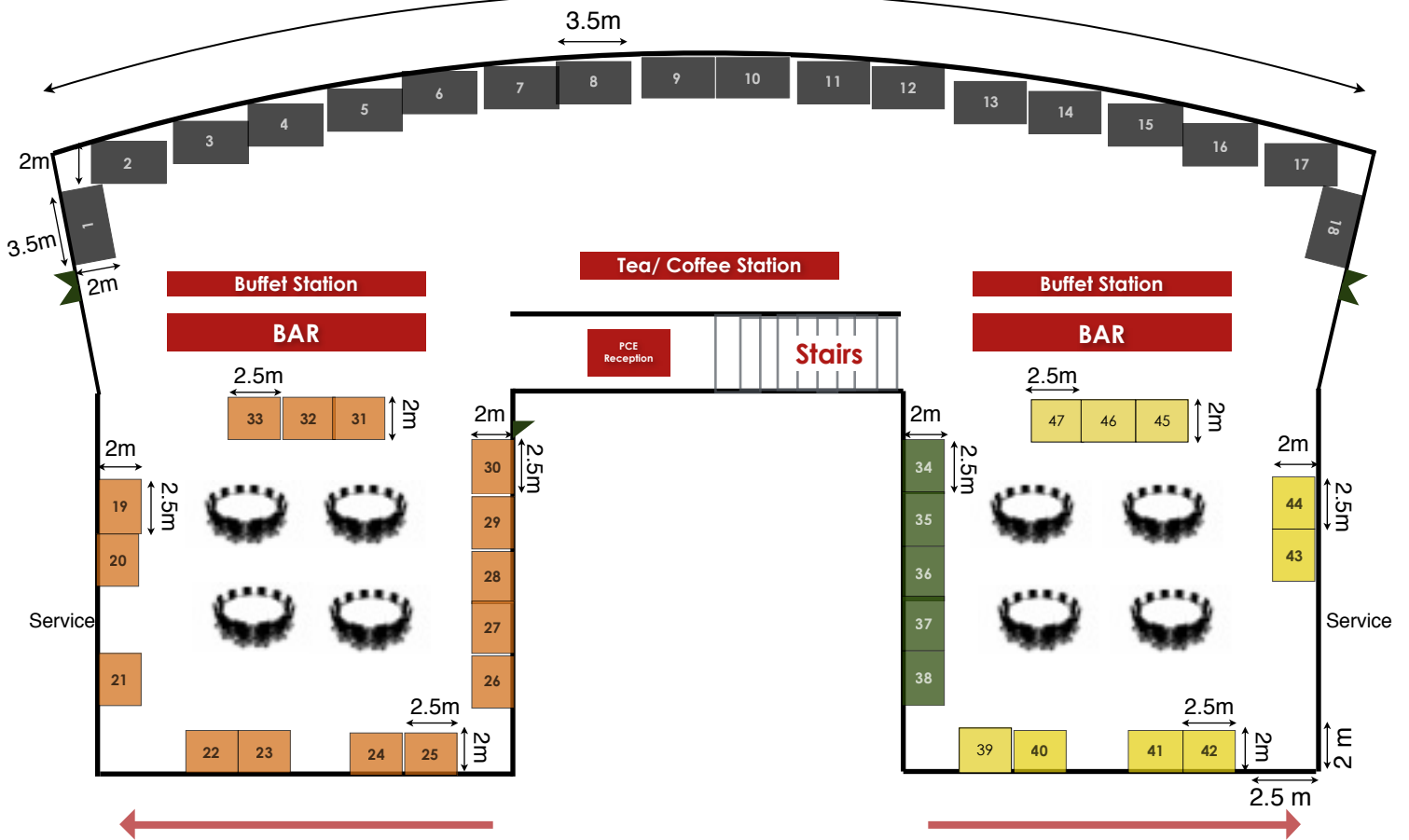
Seven sessions of 45 minutes each where our partners will demonstrate the functionality of their products using case studies or being represented by their clients from the industry.

@ Champions Suite

# Exhibit Area

Project Controls Expo is exhibiting its partner showcase at Highbury Suite

Highbury  
64.8 m



To Champions Suite  
and Dial Square

To Royal Oak & 49ers

- Technology & Advisory Services - Zone 1
- Technology & Advisory Services - Zone 2

- Education & Media
- JobZone

Networking Area

Technology & Advisory Services - Zone 1		Technology & Advisory Services - Zone 2		Education & Media		JobZone	
1	Ares Corporation	19	V1 Limited	34	University of Birmingham	39	Working for Essex
2	APMG	20	NEC	35	Gower Publishing	40	Working for Essex
3	Safran	21	Builtintelligence	36	The PM Channel	41	TRS Staffing
4	Driver Group	22	Asite	37	APM	42	Amec
5	Sellafield	23	Asite	38	ACostE	43	Harmonic Limited
6	Program Framework	24	Wellingtone			44	Scantec
7	Delttek	25	Wellingtone			45	Tech Resourcing
8	CONJECT	26	Kentz			46	Gold Group
9	RPC Uk	27	Thales Group			47	Capita
10	AECOM	28	Thales Group				
11	Oracle	29	Ecosys				
12	Milestone	30	Ecosys				
13	LogiKal	31	Enzen				
14	Qinetiq	32	Viewpoint				
15	Rhead Group	33	UNIT 4 Business Software				
16	BMT HQ Sigma						
17	Critigen						
18	Training byte size						

# Exhibitors/ Partners



## **AECOM**

AECOM is a global provider of professional, technical and management support services to a broad range of markets, including transportation, facilities, environmental, energy, water and government. AECOM is a leader in all of the key markets that it serves. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that create, enhance and sustain the world's built, natural, and social environments. A Fortune 500 company, AECOM serves clients in more than 150 countries and had revenue of \$8.0 billion during the 12 months ended March 31, 2014.

**W:** <http://www.aecom.com/>



## **AMEC**

AMEC (LSE: AMEC) is a focused supplier of consultancy, engineering and project management services to its customers in the world's oil and gas, mining, clean energy, environment and infrastructure markets. With annual revenues of some £4 billion, AMEC designs, delivers and maintains strategic and complex assets and employs around 27,000 people in about 40 countries worldwide.

**W:** <http://www.amec.com>



## **ARES Project Management**

ARES is the world leader in Project Cost Management offering innovative technology that meets the needs of diverse industries such as transportation, engineering, construction, oil & gas, mining, utilities, and aerospace. These organizations rely on PRISM to manage the full lifecycle and financial performance of capital projects. PRISM is a configurable solution with role-based interfaces, and seamless flexible integration options delivering immediate value to our clients.

**W:** <http://www.aresprism.com/>



## **APMG International**

APMG International is a global accreditation and examination institute. We administer a range of professional management qualifications and supporting accreditation schemes that support individuals and organizations in key management disciplines, including Programme and Project Management, IT Service Management and Change Management.

Our qualifications and supporting training courses are designed to equip individuals with best practice knowledge, tools and techniques to tackle key business objectives whilst improving efficiency and performance.

In support of qualifications, we accredit an international network of Accredited Training Organizations (ATOs) and Accredited Consulting Organizations (ACOs) which provide approved training and consultancy services to end users in support of our qualifications.

Committed to quality in everything we do, our qualifications and accreditation activities are developed and managed in accordance with a robust quality management system and processes accredited by the United Kingdom Accreditation Service (UKAS – the national accreditation body recognized by the UK government to accredit organizations providing certification services).

**W:** <http://www.APMG-International.com>

# Exhibitors/ Partners



## Asite

Asite helps people share information and build knowledge in a secure environment in the cloud. Every day, people all over the world use Asite to manage their projects and supply chains collaboratively to get the information they need – when and where they need it.

Adoddle is a mature and full-featured content management system which is designed to handle a wide range of content from multimedia supplier catalogs running into the millions of line items, video, complex BIM and product models, and files of all types. Adoddle allows you to store all of your content in one central, secure repository and enables customers to fully customize the structure of their content with highly controlled access.

As 2014 is now "the year of Adoddle" the Asite team Officially Launched Adoddle 17 on March 17th in Tech City's Shoreditch Town Hall. Asite are set to change the face of Collaborative Software in the Cloud; with 360° clarity, drag & drop simplicity Adoddle 17 users are no more than few clicks away from their data.

Asite are proud to exhibit at this year's Project Controls Expo. The team will be showcasing the new Adoddle 17 platform at the Expo

Follow us on twitter @Asite OR [click here](#) to view our new video.

**W:** <http://www.asite.com>



## Association for Project Management (APM)

The Association for Project Management (APM) is the largest professional body of its kind in Europe with over 21k individual and 500 corporate members, with a compelling vision for the profession which reflects what society expects: A world in which all projects succeed.

APM's mission statement is: "To provide leadership to the movement of committed organisations and individuals who share our passion for improving project outcomes". We are committed to developing and promoting professional project, programme and portfolio management across all sectors of industry through raising awareness and standards in the profession. The APM offers membership, qualifications, events, publications and much more.

**W:** <http://www.apm.org.uk/>

# Exhibitors/ Partners



## The Association of Cost Engineers

The Association of Cost Engineers was formed in 1960, in London, as the British Group of the American Association of Cost Engineers. In 1962 an independent British Association of Cost Engineers was formally and legally incorporated having similar aims and objectives to AACE. Since then ACostE has developed into an organisation which provides a range of institutional services for its members. It promotes the technical study and development of cost engineering with the objective of furthering the application of scientific principles and techniques to problems of Project and Produce Control, Cost Estimating, Scheduling, Planning, Risk Analysis, Profitability, Investment Appraisal and allied topics.

### Objectives of ACostE

- ▶ To promote Cost Engineering as a recognised discipline of engineering technology
- ▶ To provide means of developing, exchanging and disseminating standards, methods and data relating to Cost Engineering & Project Controls
- ▶ To provide recognised standards of attainment in the practise of Cost Engineering & Project Controls
- ▶ To set up and maintain proper standards of professional conduct and ethics of its members in the practice of Cost Engineering
- ▶ To hold, promote or support meetings and distribute literature and information in pursuit of its objectives
- ▶ To co-operate with other bodies in the UK and elsewhere having objects cognate with those of the Association and to liaise with other similar bodies for the purpose of the reciprocal exchange of information
- ▶ To encourage social activities among members

### Who ACostE represents:

Cost Engineers	Project and Project Managers
Project Control Managers	Estimators
Quantity Surveyors	Commercial Managers
Planning Engineers	Risk Managers
Accountants	Quality Assurance Managers
Value Engineers	Contracts Managers

**W:** <http://www.acoste.org.uk/>



## BMT Hi-Q Sigma

BMT Hi-Q Sigma provides high-value management insight and knowledge across Government, Defence, and energy and transport industries.

At the heart of our business is a commitment to helping customers transform and improve their businesses. We combine exceptional expertise in Programme Management and Systems Engineering to deliver solutions to complex problems, reducing uncertainty and enabling informed decision making, so our customers can move forward with confidence.

**W:** <http://www.bmt-hqs.com/>

# Exhibitors/ Partners



## Capita

Capita is the UK's leading provider of business process management and integrated professional support service solutions.

Our experience, capabilities and scale mean we can deliver value to clients across most industry sectors - public and private – including central government, education, financial services, health, housing, insurance, local government, transport, property and more.

We have a strong track record in transforming services, saving costs, and delivering value for our clients, for our investors and for our stakeholders.

**W:** <http://www.capita.co.uk/>



## CONJECT

CONJECT (formerly BIW Technologies) is a leading supplier of domain specific software for public and private owners, project & programme managers, consultants, engineers & contractors, subcontractors and service providers from sectors such as real estate, infrastructure, finance, engineering, energy, retail and utilities.

Our software helps clients enhance quality, reduce costs and better manage risks throughout the whole Plan-Build-Operate lifecycle of their assets. CONJECT specialises in delivering applications to clients and their authorised users on a Software-As-A-Service basis, or as it is more popularly known, 'cloud' services.

**W:** <http://www.conject.co.uk/>



## Critigen

Critigen provides integrated IT solutions and services. Our team brings industry-specific expertise and knows what makes businesses successful.

Implementation services get your applications running quickly and configured to drive success. Integration with ERP and other applications to develop error-free workflows and ensure cultural adoption.

Cloud & Hosting services for your EPPM systems. Whether using our subscription-based software or your own licenses, Critigen's hosting platform delivers your EPPM Solutions with guaranteed uptime and support expertise to sustain your business.

**W:** <http://www.critigen.com/>



## Deltek

Deltek is the leading global provider of enterprise software and project management solutions project-based organizations. Deltek delivers actionable insight that empowers our customers to unlock their business potential. Users worldwide rely on Deltek to research and identify opportunities, win new business, optimize resources, streamline operations, and deliver more profitable projects. Deltek - Know more. Do more

**W:** <http://www.deltek.com/>

# Exhibitors/ Partners



## Driver Group

Driver group has been providing consultancy services to the engineering and construction industries since 1978. We operate in offices around the globe, including Africa, Americas, Asia Pacific, Europe, and the Middle East.

Driver Group delivers the full spectrum of engineering and consultancy services with specialists operating within each of the Group's five core brands: DIALES, Driver Project Services, Driver Trett, Driver Corporate Services, and Driver Project Management.

**W:** <http://www.driver-group.com/>



## EcoSys

EcoSys is the global standard for enterprise Project Controls software. Our easy-to-use web-based platform, EcoSys EPC, helps organisations worldwide plan and manage project portfolios, control project costs, and improve project performance.

Our customers execute some of the world's largest projects and rely on EcoSys EPC to implement best practices for full lifecycle project controls including project cost management, project portfolio management (PPM), capital programme management, budgeting, forecasting, estimating, workforce planning, and earned value management.

**W:** <http://www.ecosys.net/>



## Enzen Global

Enzen Global is an innovative, knowledge-based energy and utility enterprise serving the Gas, Power and Water sector. We provide outcome based turnkey solutions, blending industry best practices and leading edge ideas with a continuous focus on exceeding our customers' expectations.

**W:** <http://enzenglobal.co.uk/>



## Essex

Based on site at Essex County Council, the team have recruiting on site for 6 years. Home to 1.4 million residents, in a period of exciting transformation, moving to a more commercially focussed, forward thinking organisation the council offers a real opportunity for a fulfilling role. Ranging from permanent to interim positions, project managers to planners with vacancies spread across the County, we would be delighted to discuss the next step in your career.

**W:** <http://www.workingforessex.com/>



## Gold group

Gold Group recruitment agency has been supplying planners and project controls professionals for 14 years. We work with forward thinking leading organisations who understand their business is built on the people they employ.

**W:** <http://www.goldgroup.co.uk/>

# Exhibitors/ Partners



## Gower Publishing

Gower Publishing is an independent global publisher, widely recognized as a specialist in project management books and resources. Gower's publishing programme includes a range of over 100 titles from classic project management books through to the most challenging and cutting edge works. Our expert authors are continually developing new titles and are drawn from the most respected academic institutions and industries worldwide.

**W:** [www.gowerpublishing.com/projectmanagement](http://www.gowerpublishing.com/projectmanagement)



## Harmonic

Harmonic provides enterprise-wide business winning and project delivery services through close, long- term client relationships that are underpinned by mutual trust and an ability to drive profitable and sustainable growth for our clients. We integrate with our client's team, making a disproportionate impact by supporting them to pursue the right opportunities in the best way, and to deliver their contracts more effectively and profitably. Our approach to integrating with clients' teams radically improves effectiveness, which means we are confident in taking on significant challenges and linking our remuneration to results.

**W:** <http://www.harmonicltd.co.uk>



## Kentz

Kentz, a Member of the SNC-Lavalin Group, is a global engineering specialist solutions provider, with 15,500 employees operating in 36 countries worldwide. We have provided Engineering, Construction and Technical Support Services (TSS) to clients in the energy and resources sectors for more than 90 years.

Kentz Group has been delivering top-quality services to leading international clients in all sectors of industry and commerce since 1919. With an extensive track record in executing projects of the highest quality, to agreed schedules and within budget; we are totally dedicated to innovation and excellence in the provision of all our services.

**W:** <http://www.kentz.com/>



## Logikal Projects

LogiKal Projects is focused on developing and implementing world class Project Controls solutions for our clients, we offer a full range of services built around the 3 pillars of People, Process and Systems. Whether it be providing expert resource to your projects, strategic partnering to implement high quality Controls processes, helping you achieve the right technology solution to enhance your projects or providing industry specific, practical courses to your teams – LogiKal Projects is the answer.

**W:** <http://www.logikalprojects.co.uk/>



# Exhibitors/ Partners



## Milestone

Specialists in portfolio, programme and project management consultancy, software and training. Milestone has been unlocking the potential from project management software for the past twenty years to thousands of satisfied customers. As a Specialised Oracle Platinum Partner, Milestone develops solutions utilizing the Oracle Primavera suite and other industry-leading complementary products. In addition to delivering software solutions, Milestone offers a complete range of consultancy services complementing the solutions; installation, integration, configuration and implementation, health checks, Oracle Accelerate and Oracle University and bespoke training.

**W:** <http://www.milestoneuk.com/>



## NEC

NEC is an internationally recognised family of contracts that facilitates the implementation of sound project management principles and practices as well as defining legal relationships. The suite is suitable for procuring a diverse range of works, services and supply, spanning major framework projects through to minor works and purchasing of supplies and goods.

**W:** <http://www.neccontract.com>



## Oracle- Primavera

Oracle- Primavera, a wholly owned subsidiary of Oracle Corporation, is the leading worldwide provider of enterprise project portfolio management (PPM) solutions for project intensive industries. Primavera's PPM software helps companies propose, prioritise and select project investments and plan, manage and control the most complex projects and project portfolios.

**W:** <http://www.oracle.com/index.html>



## Program Framework

Program Framework is a specialist PPM consultancy and Microsoft Gold Partner. We offer a mix of project management, collaboration consultancy and technology services. We work with a range of products, including Microsoft Project Server, Project Online, Office 365, SharePoint and also Nintex and ProSymmetry. Program Framework is the trusted partner of many organizations across a wide range of sectors. We are technology experts, and also understand and deliver the change management and adoption activities required for on-going success.

**W:** <http://www.programframework.com/>



## QinetiQ

QinetiQ is a FTSE250 Company with over 6,000 employees Worldwide. We are a trusted advisor to Governments and Organisations, helping solve intractable problems in complex and regulated markets, including Defence, Oil & Gas, Rail and Nuclear.

QinetiQ's Procurement Advisory Services division helps clients make informed, value-for-money acquisitions, compliant with legal and policy frameworks.

We are the only Company with the scale to augment delivery of Complex Programmes and Projects to schedule, budget and specification, whilst remaining independent from major solution Suppliers.

**W:** <https://www.qinetiq.com>

# Exhibitors/ Partners



## **Rhead Group**

Rhead Group is an international professional services consultancy providing a range of solutions for the lifecycle of infrastructure, construction and asset management programmes. Our expert consultants are motivated to deliver excellence within a culture that promotes collaboration and innovation. We differentiate ourselves through our ability to adapt and respond quickly to our clients' needs. Our project teams utilise the wealth and breadth of our international expertise, whilst possessing the local knowledge necessary to support projects wherever they are in the world.

**W:** <http://www.rheadgroup.com/>



## **RPCuk**

RPCuk offers successful project delivery expertise, acquired over the course of over 20 years, and has harvested best-in-class products and services from leading global vendors to assemble a comprehensive portfolio of solutions to support the complete project lifecycle. It provides a complete project planning solutions provider. From infrastructure, software and consultancy skills to deployment, education and support services, RPCuk can provide the ideal platform for delivering projects successfully, on time and within budget.

**W:** <http://www.rpc.uk.com/>



## **Safran**

Safran Software Solutions, headquartered in Stavanger with offices in Houston, London and Oslo, is a leading provider of Enterprise Project & Risk Management (EPRM) software solutions to project- and asset-intensive industries. Safran is recognized globally for streamlining the EPRM process while elevating project delivery confidence through its integrated project reporting, risk and change management capabilities. Safran prides itself on speed of product adoption and customer satisfaction which ensure the greatest value for its customers.

**W:** <http://www.safran.com>



## **Scantec**

Scantec is one of the UK's leading independent recruitment agencies specializing in the Technical, Engineering and Scientific sectors. Servicing a wide range of commerce and industry throughout the UK. Scantec supplies high caliber personnel in a fast, efficient and professional manner.

**W:** <http://www.scantec.co.uk>



## **Sellafield Ltd**

Sellafield Ltd is the company responsible for safely delivering decommissioning of the UK's nuclear legacy as well as fuel recycling and the management of low, high and intermediate level nuclear waste activities on behalf of the Nuclear Decommissioning Authority.

Sellafield Ltd has sites at Sellafield in West Cumbria and engineering, design and functional support capability are provided by employees based at our Risley office, near Warrington.

**W:** <http://www.sellafieldsites.com/>

# Exhibitors/ Partners



## Thales Group

Part of the Thales Group, Thales Learning & Development (TLD) is a trusted provider of innovative L&D solutions, with hard-won expertise spanning across management and leadership, personal development, IT and business systems, engineering and project management. TLD is a proven strategic partner, impacting individual and organisational performance through genuinely bespoke learning interventions. Since its creation, TLD has seen its turnover grow to over £11m. The business now employs roughly 60 people, from L&D consultants to operational staff, and has achieved Gold Investors in People Accreditation.

**W:** <http://www.thales-ld.com/>



## Training Byte Size

The Assessment Service Centre (TASC) provides training, competence assessment services for Project Control Professionals in key disciplines, including; Cost Engineering, Estimating, Planning and Expediting. As an Engineering Construction Industry Training Board (ECITB) approved centre and training provider TASC is able to deliver a range of Nationally Accredited Vocational Qualifications at levels 2, 3 & 5 in the Qualifications Credit Framework (QCF). Such qualifications have application in industries as diverse as Petro-chemicals to Defence, Utilities to Transport and Manufacturing to Government. These qualifications test both knowledge and competency of the learners in a work environment. In addition TASC provides benchmarking and training needs consultancy for a diverse range of business sectors. Working with the Association of Cost Engineers (AcostE), TASC provides assessment for the professional accreditation program that was recently introduced

**W:** <http://www.trainingbytesize.com>



## TRS Staffing Solutions

TRS Staffing Solutions is a world leading recruitment company for professional, engineering, technical and field services talent. With 30 years' expertise, TRS Staffing Solutions has been developing resources, skills and specialist expertise to benefit our clients and candidates. TRS Staffing Solutions places candidates across six continents on a contract, direct hire or permanent basis. Clients include industry leaders, global owners and operators, as well as engineering, procurement and construction (EPC companies), major consultancies and government departments.

**W:** <http://www.trsstaffing.com/>



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We provide project/process quality assurance (Assure) and document management/project collaboration (Business Collaborator) software solutions to the AEC sector. Our software is used across thousands of projects and organisations to help customers deliver built assets. Assure ensures the things you do are correctly documented, follow process, adhere to standards, are easily auditable, meet agreed milestones and are ready for handover. Business Collaborator helps projects large and small manage documents/drawings, handle reviews/approvals/workflow in a fully auditable and searchable solution in the cloud.

**W:** <http://www.unit4.com/>

# Exhibitors/ Partners



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**W:** <http://www.birmingham.ac.uk/index.aspx>



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**W:** <http://4projects.com/>



## V1 Professional Services Automation

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Visit stand 19 to find out more.

**W:** <http://www.wearev1.com/psa-software/>



## Wellington

A specialist project management company based in Berkshire, working with clients across UK and internationally. Established since 1995, our clients come from all industries, both public and private sectors and range from household names to SMEs. The one thing that all our clients have in common is that they all run projects.

Our goal is to work as a partner with our clients to maximize their likelihood of project, programme and portfolio success. Whether this helps defining a fit for purpose & practical project methodology, training people in best practice project management, implementing Microsoft Technology solutions such as Microsoft Project Server and SharePoint or helping clients recruit project professionals, we can help!

**W:** <http://www.wellington.co.uk/>



# Agenda Snapshot

Zone	Master Class Zone 1 @ Royal Oak Suite	Technical Zone @ Champions Suite	Master Class Zone 2 @ Dial Square Suite
Timings			
0800 - 0845	<b>Registration and Coffee @ Highbury Suite (Partner Showcase Zone)</b>		
0845 - 0920	Introduction and key note presentation on "Changing face of Project Controls" @ Royal Oak Suite <b>Speaker:</b> David Birch, Head of Project Controls, National Grid UK		
0930 -1015	<b>Session M1:</b> Agile and Earned Value <b>Speaker:</b> Stephen Jones, APM PMC SiG Chairman, UK & SPER Programme Lead, Sellafeld Limited UK	<b>Session T1:</b> Effective Project Portfolio Management for Greater Cash Flow & Risk Management <b>Speaker:</b> George Haddad, Senior Director, Business Development & Industry Strategy, Oracle	<b>Session W1:</b> Progress, Position, Prediction - The Key to Completing Projects on Time <b>Speaker:</b> David Bordoli BSc MSc FCIOB MAPM ACI Arb Director and Forensic Delay Analyst, Driver Group UK
1030 -1115	<b>Session M2:</b> Pacing Delay - The Practical Effect on Projects & Delay Claims <b>Speaker:</b> Jim G Zack Jr, Executive Director, Navigant Consulting, USA	<b>Session T2:</b> Effective programme level contract management <b>Speaker:</b> Andy Cruise, National Contracts Manager, National Grid UK	<b>Session W2:</b> Getting the truth, the whole truth and nothing but the truth from your suppliers <b>Speaker:</b> Ben Vaughan Principal Consultant, BMT HQ Sigma
1115 -1145	<b>Mid Morning Coffee Break</b>		
1145 -1230	<b>Session M3:</b> Lawyer's/Legal take on Project Controls Framework <b>Speakers:</b> Joint presentation by Ewen Maclean (Principal, Construction Practice Leader, Berkeley Research Group, UK) & Robert Horne (Partner with Trowers & Hamlin, UK)	<b>Session T3:</b> The Future of Globally Integrated Project Controls Teams <b>Speaker:</b> Chris Bell, Sr Consultant, Ares Corporation, USA	<b>Session W3:</b> Schedule Risk Analysis for Complex Projects <b>Speaker:</b> Andy Abu-Bakar, Risk Consultant, Rhead Group
1245 -1330	<b>Session M4:</b> Practical Applications of a Risk Management Framework <b>Speaker:</b> Ben Hubbard, Nexus PMG, USA	<b>Session T4:</b> The 6 Key Elements for Improving Project Maturity and Visibility <b>Speaker:</b> Jim Malkin, Director PPM - International UK	<b>Session W4:</b> Benchmarking Project Health: Enhancing Confidence, Assuring Delivery <b>Speakers:</b> Mark Lee, Head of Profession (Programme Assurance) & Steve Elwell, Director Strategic Advisory Services, QinetiQ
1330 -1430	<b>Lunch Break</b>		
1445 -1530	<b>Session M5:</b> BIM and the Project Controls Bicycle <b>Speaker:</b> Adrian Malone, Faithful+Gould	<b>Session T5:</b> Embedding best practice processes and automation within your project teams. <b>Speaker:</b> Gero Renker, Co-founder and Director of Enterprise Project Management, Program Framework, UK	<b>Session W5:</b> Managing NEC3 contracts and the Associated Programme <b>Speaker:</b> Glenn Hide, BuiltIntelligence
1545 -1630	<b>Session M6:</b> Cost Estimate Risk Analysis: For Capital Projects and Maintenance Turnarounds <b>Speaker:</b> Steve Jewell, Practice Leader, Risk Management - Capital Projects at Asset Performance Networks, UK	<b>Session T6:</b> Aligning Corporate and Project Stakeholders with Safran and SAP <b>Speaker:</b> Richard Wood, Safran VP of International Development	<b>Session W6:</b> Constructive Acceleration - A Global Tour <b>Speaker:</b> Jim G Zack Jr, Executive Director, Navigant Consulting, USA
1630 -1700	<b>Afternoon Coffee Break</b>		
1700 -1745	<b>Session M7:</b> Productive Forecasting <b>Speaker:</b> Mike Younger, Head of Project Services, Jacobs Corp., UK	<b>Session T7:</b> The computer age and estimating - don't forget the fundamentals <b>Speaker:</b> Alan Chilcott, Assessor and Course Presenter/ Trainer, TASC	<b>Session W7:</b> Project Delivery , growth and collaboration <b>Speaker:</b> Ken Phillips, Planning Lead at Amec UK
1800 - 1815	<b>Wrap up and Q&amp;A @ Royal Oak Suite</b>		
1815 -1845	Evening Social @ Highbury Suite offering final opportunity to network with pint of beer, wine and soft drinks <b>Open to ALL</b> (Also, "Stadium tour" for pre-registered delegates from 1800 -1830 hrs)		
1900 - 2230	<b>Exclusive Dinner @ WM Club hosted for Speaker, Sponsors and pre-registered guests/ delegates</b>		

We aim to upload all the presentations and videos on PCO Infopad (<http://projectcontrolsonline.com/InfoPad.aspx>) under "Events Proceedings" section. Please note some of the presentations may be excluded due to copyright or confidentiality reasons.

# Detailed Agenda

## Introduction and key note presentation on “Changing face of Project Controls”



**David Birch**  
Head of Project Controls, National Grid UK

**08:45 -09:20**  
**Royal Oak Suite**

### Topic Synopsis

I believe that project delivery challenges are driving organisations towards greater integration and changing the way we should approach Project Controls within project delivery organisations.

This presentation captures my thoughts on a way forward for Project Controls within a Project Delivery organisation discussing:

- Scope definition and Work Breakdown techniques driving more effective data integration (Single sources of key data from numerous functions)
- Improvements in systems and system integration
- Use of Data Warehouses and Management Information systems
- Utilisation of BIM incorporating 4th (Time) and 5th (Cost) dimensions
- Taking a simpler higher level approach to creation of a control model
- Use of an Earned Value Management system and EV Maturity Compass
- The need for a wider range of skills to deliver good control
- An integrated industry approach to career definition, development, training and qualifications for Project Controls within the Project Management umbrella

My experience tells me that there is no single 'magic ingredient' to delivering successful projects; but greater integration of management and team activities, intelligent application of recognised best practices and fit-for-purpose processes, tools and systems would benefit UK construction as a whole in the future.

### Bio

David Birch has 35 years experience in the delivery of high profile UK and international project portfolios for world leading engineering contractors. He had responsibility for the CLM Programme Controls group within the CLM Joint Venture delivering the London 2012 Olympic Games programme on behalf of the UK Olympic Delivery Authority (ODA). Mr Birch's priorities are to ensure that the London 2012 programme is delivered to or ahead of schedule and within the funding levels and budgets established by the ODA. Since joining CH2MHill in 2008 Mr Birch has served as CLM Head of Programme Controls for from December 2008 to today and was CLM Deputy Programme Controls Manager from May to December 2008.

Prior to joining National Grid, Mr Birch was with CH2M overseeing London 2012 Olympics, UK Operations Manager for URS/Washington Group Energy and Environmental Group executing projects and programmes within UK Nuclear decommissioning and clean-up. Previous experience includes 10 years with Bechtel working on International projects in the Oil and Gas, Water and Telecom Business Lines located in Kuwait, Kazakhstan, India and a number of European countries.

# Detailed Agenda

## Agile and Earned Value



**M1**  
**09:30 - 10:15**  
**Royal Oak Suite**

### Stephen Jones

APM PMC SIG Chairman, UK & SPER Programme Lead, Sellafield Limited UK

## Effective Project Portfolio Management for Greater Cash Flow & Risk Management



**T1**  
**09:30 - 10:15**  
**Champions Suite**

### George Haddad

Senior Director, Business Development & Industry Strategy, Oracle

## Progress, Position, Prediction - The Key to Completing Projects on Time



**W1**  
**09:30 - 10:15**  
**Dial Square Suite**

### David Bordoli

BSc MSc FCIOB MAPM ACI Arb, Director and Forensic Delay Analyst, Driver Group UK

### Topic Synopsis

Over the last 15 years, Agile software development methods have been developed to deliver higher quality software, better and faster, whilst being able to react to changing (or poorly defined) client needs.

Earned Value Management (EVM) is a good practice approach used for the planning, management and control of projects and programmes. It measures cost and schedule against a baseline, to produce a simple set of metrics providing early warnings of performance issues, allowing for timely and appropriate adjustments.

There are some misconceptions that EVM techniques are too difficult to implement effectively on an Agile project.

### Bio

Stephen Jones is the Chairman of the APM Planning, Monitoring and Control Specific Interest Group. He is a Registered Project Professional, and a chartered Electrical Engineer. His Project Management experience comes from the Nuclear Industry, where he is currently a Project Manager at Sellafield Ltd working for the Major Project directorate.

Sellafield Ltd is the company responsible for safely delivering decommissioning of the UK's nuclear legacy as well as fuel recycling and the management of low, high and intermediate level nuclear waste activities on behalf of the Nuclear Decommissioning Authority. Sellafield Ltd has sites at Sellafield in West Cumbria. Engineering, design and functional support capability are provided by employees based at their Risley office, near Warrington.

### Topic Synopsis

Today more than ever, corporations are faced with a vast array of choices about where to invest to grow and prosper. There are also mounting pressures to perform and little room for errors when deciding on their portfolio's investment mix. Poor project management can lead to huge financial losses and increased risk. Executives and senior managers are learning how effective project portfolio management is a key ingredient to building value while taming uncertainty, not to mention preserving their own reputation and tenure.

### Bio

George Haddad joined the Oracle Primavera Global Business Unit as Senior Director of Product Strategy as a result of the acquisition of Skire, Inc. in 2012. George brings over twenty nine years of software product strategy, product design, and management combined with building design and construction industry domain experience to Oracle. Currently George is responsible for global business development and industry strategy.

At Skire, George served as Vice President of Product Strategy and Management where he was charged with establishing and executing Skire's strategic product direction, vision and roadmap and leading the product management team. During his tenure, he successfully led and launched the company's next generation best in class cloud-based products.

### Topic Synopsis

Show me a project that is in delay and I'll show you a project that is losing money". It is a fact of life that most major projects are completed later than originally planned and struggle to make the returns, especially for the contractor, that were envisaged. The key to completing projects on time is planning, monitoring progress, deterring the project position and forecasting the completion. This allows informed decision making about what changes need to be made to bring a project back onto schedule. Various established methods of measuring progress and project position are presented along with a straight-forward way of predicting project completion that allows those unfamiliar with Earned Value techniques to make decisions about the extent of change required to bring a project in on time.

### Bio

David has over 30 years in the construction industry. Throughout his career he has specialised in planning and programming, initially with contractor organisations and latterly as a consultant specialising in forensic delay analysis. He is an experienced expert witness with his first appointment in 1989 where he used, the then, innovative network techniques to analyse the delays. David is academically and professionally qualified and is the author of numerous high quality papers and seminar presentations. He was awarded an MSc degree with distinction for his work on 'The simulation of construction project delays using network techniques', the method of analysis developed is now known as 'Time Impact Analysis'. His book, 'A Handbook for Construction Planning and Scheduling', co-authored with Andrew Baldwin, was published by Wiley Blackwell in May 2014. David is still involved in 'live' work, alongside providing contractual advice & preparing time delay claims.

# Detailed Agenda

## Pacing Delay - The Practical Effect on Projects & Delay Claims



M2  
10:30 - 11:15  
Royal Oak Suite

### Jim G Zack Jr

Executive Director, Navigant Consulting, USA

#### Topic Synopsis

This paper is focused on pacing delay, a controversial delay issue in the construction industry. Currently there is little literature on pacing delay and case law is a bit sparse. Thus, owners and contractors often find themselves at odds with one another over the practical effect of pacing delay in a delay claim situation. This paper defines the term; identifies what constitutes pacing delay; and sets forth the contractor's legal right to pace an owner caused delay and addresses the practical impact of a pacing delay, both to the project as well as to a delay claim. This paper is intended to assist in a better understanding of pacing delay and how the issue may be dealt with by both owners and contractors.

#### Bio

James G. Zack, Jr. is the Executive Director of the Navigant Construction Forum. The Forum strives to be the construction industry's resource for thought leadership and best practices on avoidance and resolution of construction project disputes globally. Formerly he was the Executive Director, Corporate Claims Management, Fluor Corporation, one of the world's largest publicly-owned engineering, procurement, construction and maintenance (EPCM) contractors.

Mr. Zack was previously Vice President of PinnacleOne and the Executive Director of the PinnacleOne Institute and a Senior Construction Claims Consultant for CH2M HILL, Inc. Mr. Zack has, for more than 40 years, worked on both private and public projects. In the construction claims field, he is a recognized and published expert in mitigation, analysis and resolution or defense of construction claims and disputes.

## Effective programme level contract management



T2  
10:30 - 11:15  
Champions Suite

### Andy Cruise

National Contracts Manager, National Grid UK

#### Topic Synopsis

Contract Management at a programme level is a challenge that many of us will recognise. The challenge can include trying to manage a huge amount of client/contractor interactions, a myriad of contract terms, prioritising work, dealing with unstructured / high volume data and ultimately, making timely decisions that deliver value. To achieve this we need to organise ourselves effectively and equip our people with the resources, skills and knowledge they need to reach their potential.

I'm looking forward to taking the opportunity to speak with you to explore some of the challenges and successes that I have experienced with National Grid in managing contracts at a programme level, what we have learned and where we go next.

#### Bio

Andy has 15 years experience in contract management across gas, electricity and telecoms utilities.

Andy's most recent roles have focused on developing contract strategy for a number of large contractors. Andy lead the development of contract management capability across National Grid to enable delivery of capital programmes with a value in excess of £1bn p.a.

Mr Cruise's current focus is to manage a portfolio of > 200 contracts to provide maintenance engineers at National Grid with goods and services to maintain the grid's excellent reliability.

## Getting the truth, the whole truth and nothing but the truth from your suppliers



W2  
10:30 - 11:15  
Dial Square Suite

### Ben Vaughan

Principal Consultant, BMT HQ Sigma

#### Topic Synopsis

The path of true project controls data never runs smooth...but why? Because customers are from Mars and suppliers are from Venus? Because all suppliers are devious fraudsters and all customers are naïve and gullible? Or is it just that requirements, expectations and rules of engagement aren't bilaterally agreed at the outset of the relationship? Drawing on real life experiences from both sides of the fence this presentation aims to dispel myths, identify common problems and provide some tactical advice for fostering a more collaborative approach to effective projects controls.

#### Bio

Ben Vaughan is a Senior Consultant at BMT HI-Q Sigma who specialises in Risk Management and EVM. His experiences are shaped by the Surface Ships Industry, having been a Project Manager on HMS Queen Elizabeth, the new Royal Navy Aircraft Carrier, and a Risk Manager for the next generation of RN Frigates, the Type26 Global Combat Ship. Ben has a BA in History, an MSc in Engineering Management and is currently studying for his MBA.



# Detailed Agenda

## Lawyer's/Legal take on Project Controls Framework

M3  
11:45 - 12:30  
Royal Oak Suite



**Robert Horne**  
Partner with Trowers & Hamlin, UK



**Ewen Maclean**  
Principal, Construction Practice Leader,  
Berkeley Research Group, UK

### Topic Synopsis

Project control is usually perceived as a deeply practical matter often focussed on internal process and procedure within a company; but is it? This presentation will look at the legal ties and relationships within a project (contractual, statutory and tortious) and how they do, should or could correlate with project controls. It will highlight areas where legal relationships interface with practical project reality and discuss how to maintain a balance between flexibility and certainty when bringing project control into the legal arena. These ideas will be developed in a practical exercise of risk identification within a project and how that risk can be balanced through project control within the legal and contractual framework. It will also explain the benefits that can be achieved through formalising, in a legal context, project controls and discuss the commercial tipping point of introducing too much project control.

### Bio

Rob Horne is a partner at an international law firm and has specialised in finding solutions to project based problems in the construction industry for some 20 years. He represents and advises clients on major projects in the UK and internationally, particularly in the Middle East, on projects as diverse as PFI hospitals, oil and gas pipelines, major new rail connections and large scale mixed use developments. He sits as an adjudicator and arbitrator and is a recognised expert in the NEC form of construction contract. He is the author of the book "The Expert Witness in Construction" and a contributing author to the book "Human Dynamics in Construction Risk Management" as well as a regular speaker on a wide range of construction and project based topics.

### Bio

Ewen Maclean, Eur Ing MEng (Hons) MSc (Const. Law & Arb) CEng FICE FCI Arb, Construction Practice Leader, Berkeley Research Group  
Ewen is an experienced expert in the field of programming; delay and disruption; and associated prolongation costs in relation to construction and engineering projects. In particular, he has worked for both international consultants and contractors and has first-hand experience of assisting and representing clients in litigation, arbitration, mediation and adjudication, both for the claimant and respondent. He has prepared numerous expert witness reports; drafted standard forms of contract and lectured on various commercial and contractual subjects within the construction industry. Ewen has also acted in commercial negotiations and settlements, resolving potential disputes as well as providing advice on contract procurement. Ewen is well versed in many of the standard forms of construction contract including the NEC, JCT, ICE, FIDIC, GC Works Conditions as well as bespoke forms of contracts including PFI contracts and has worked on contracts that span, inter alia, major building, civil engineering, oil and gas, mechanical and electrical, pharmaceutical, infrastructure including highways and rail as well as fit-out works.

# Detailed Agenda

## The Future of Globally Integrated Project Controls Teams



T3  
11:45 - 12:30  
Champions Suite

### Chris Bell

Sr Consultant, Ares Corporation, USA

#### Topic Synopsis

According to PWC, the average merger and acquisition deal size for EPC organizations was the highest it has been in 5 years. With this as the backdrop, the majority of project control teams are still highly fragmented and their cost centers belong to the geographic region or division they are in. However, when you read the "tea leaves" of the best in class firms - that is not what the future looks like.

The trend in projects is also bigger and more complex giving rise to terms such as giga-projects because mega-project could no longer characterize the risk and complexity these large firms were taking on. Combine these two forces newly created mega companies and newly awarded mega projects and you now need mega project controls. Not just big organizations with lots of disciplines but the absolute A team in an organization. The trouble is finding them in this highly fractured environment within your organization and then enabling them to work as an effective team immediately on the highest risk project your company has ever taken on.

#### Bio

For over 20 years, Chris Bell has served as an advocate for the project controls discipline in organizations all around the world. What started out as a passion for technology applied to project management turned into a whirlwind career that started "in industry" working for URS Corporation (newly acquired by AECOM) and subsequently led him to strategic career moves to each of the best technology companies serving every major discipline of project controls. This journey gives Chris a unique perspective on the interdependency that exists among process standards, software tools and project controls practitioners.

Prior to dedicating his career to technology, he worked in project management, business development and marketing for URS, and a regional Design/Build construction firm.

Chris is a regular speaker at industry conferences such as Integrated Program Management Conference (IPM), Project Management Institute (PMI) Global Congress, National Defense Industrial Association, Association for the Advancement of Cost Engineering (AACE) and many others. He is also a published author of EVM for Dummies, 7 Habits of Highly Effective Projects and many other industry articles and whitepapers.

Chris holds a Bachelor of Science degree from Mansfield University, PMP from Boston University and holds PM certifications from Project Management Institute, the Construction Industry Institute and Arizona State University.

## Schedule Risk Analysis for Complex Projects



W3  
11:45 - 12:30  
Dial Square Suite

### Andy Abu-Bakar

Risk Consultant, Rhead Group

#### Topic Synopsis

Schedule Risk Analysis is used on a wide range of projects as an established technique for identifying the uncertainties that threaten (or enhance) project success. However, applying the technique effectively to produce valid results on large and complex projects poses more of a challenge. This presentation summarises an approach to conducting schedule risk modelling for complex, long-term engineering projects, avoiding common pitfalls, and ensuring that outputs can be used to actively influence the project's outcome.

#### Bio

Andy Abu-Bakar is Risk Assurance Services Lead at Rhead Group. A Chartered Engineer, Andy spent the early part of his career in the development of novel technology, running aircraft and land equipment trials and certification activities, and managing multi-million pound defence contracts. As a project management and risk consultant, he has worked with a number of high profile industry and public sector clients in developing and implementing controls solutions for aerospace, maritime and construction sectors. Andy joined Rhead Group in 2013, where he oversees delivery of risk management support and analysis services for defence and infrastructure clients: he is currently supporting one of the UK MoD's major acquisition programmes.

# Detailed Agenda

## Practical Applications of a Risk Management Framework



**M4**  
**12:45 - 13:30**  
**Royal Oak Suite**

**Ben Hubbard**  
Nexus PMG, USA

## The 6 Key Elements for Improving Project Maturity and Visibility



**T4**  
**12:45 - 13:30**  
**Champions Suite**

**Jim Malkin**  
Director PPM - International UK

### Topic Synopsis

As construction projects continue to increase in size and complexity, so does the inherent risk that organizations must take on to win work. As a result of globalization in the capital construction industry, organizations are faced with the challenge of executing projects under tighter budgets and highly compressed schedules. This has led to thinner profit margins and the increased need for competitive cost positioning. This presentation seeks to demonstrate the value of a robust risk management framework at all levels of an organization. This includes:

- Risk management for identifying corporate strategy and market opportunities
- Using risk assessment to establish corporate risk reserves
- Refining the estimate process at the bid stage by using risk analysis to eliminate the "compounding contingency" effect
- Analyzing and quantifying ongoing project risk exposure
- How to involve your client in the risk management process

### Bio

Mr. Hubbard has experience in the EPC industry working on large capital projects ranging in value from \$1B to \$11B in the Biomass, Power, Mining & Metals and O&M industries. He has experience in managing lump sum and cost reimbursable contracts in North America, East Asia and the Middle East. Prior to co-founding Nexus PMG, he was a Project Controls Manager for Fluor Corporation. Mr. Hubbard is a certified Project Management Professional (PMP) and holds a B.S. in Mechanical Engineering from Texas Tech University and an MBA from the Isenberg School of Management at the University of Massachusetts.

### Topic Synopsis

Do you know where your project or portfolio stands on cost, schedule and value? If you needed that information right now, would you be able to find it? The ability to answer these questions is a mark of project maturity and visibility. Project-based businesses need visibility in six key areas to proactively manage their business and avoid schedule surprises, enable predictability and better manage profit margins. Highlights include -

- Six guidelines for improving project visibility
- Methods for gaining actionable insight during planning and statusing
- A framework to determine and improve project maturity

### Bio

Jim is currently the Director IPM - International for Deltek. Previously the PMO Director for General Dynamics European Land Systems where he led the implementation of professional development, process development, project management tools and practices across the business for the entire project lifecycle from business capture through to project completion. Jim has over 18 years of project management experience across many industry sectors and has been volunteering for the Association for Project Management (APM) since 2002 and is a member of the Planning, Monitoring & Control Specific Interest Group (PMC-SIG).

# Detailed Agenda

## Benchmarking Project Health: Enhancing Confidence, Assuring Delivery

W4  
12:45 -13:30  
Dial Square Suite



**Mark Lee**  
BSc MBA CEng MIET MIMechE MCMl  
Head of Profession  
(Programme Assurance)



**Steve Elwell**  
Director Strategic Advisory Services,  
QinetiQ

### Topic Synopsis

**An exploration of the practical application of QinetiQ's Risk and Cost audit models to benchmark project (and business) health and improve forecast cost and schedule out-turn**

Drawing on case examples, the speakers will describe how QinetiQ's audit capabilities are used to assess risk and cost maturity of projects and organisations. They will explore how the models are applied to establish current maturity levels and develop prioritised action plans, allowing organisations to focus on delivering rapid and tangible improvement.

### Bio

Mark is a Chartered Engineer with over 25 years' experience in Defence and Aerospace, ten of which have been in consultancy with QinetiQ and Babcock International Group. He has extensive engineering and project management experience in complex Defence Maritime projects, including the current and future UK Strategic Deterrent and the Queen Elizabeth Class Aircraft Carrier. His risk management experience spans Maritime, Air, Land and Weapons. An MSP® Registered Practitioner, Mark has also managed QinetiQ's largest Space research programme, run a small consultancy practice and managed a £m portfolio of engineering support sub-contracts. His career has taken him across Europe and as far afield as Canada and India. Mark heads the Risk and Programme Assurance function within Procurement Advisory Services (PAS), leading a team of specialists who deliver client advice and support across programme, project and risk management. He is QinetiQ's lead practitioner in Risk Management Maturity Assessment, having applied the QinetiQ Risk Maturity Model (QRMM) to benchmark risk proficiency across MOD (in DE&S and at HQ level) and in Oil & Gas, in both the UK and India.

### Bio

Steve leads Strategic Advisory Services, the arm of QinetiQ's Procurement Advisory Services (PAS) business that supports international clients across procurement, decision support and complex change management programmes. He is a highly experienced director who has built a strong reputation for working with client teams to successfully deliver and implement complex programmes that involve a significant degree of change. He has considerable experience in defence acquisition and advises both the public and private sector on acquisition issues. Over the last 13 years, Steve has managed a number of large programmes across a range of industries and is experienced in providing his clients with a single point of contact in the delivery of high quality solutions. He has operated in key leadership roles across the defence and security sector covering operational analysis, programme management, economic modelling, human factors and business growth. He specialises in the development of output-based models and economic modelling solutions focused on the capture, analysis and modelling of data in order to achieve key business goals and continuously improve the performance of a business.

# Detailed Agenda

## BIM and the Project Controls Bicycle



M5  
14:45 - 15:30  
Royal Oak Suite

**Adrian Malone**  
Faithful+Gould

### Topic Synopsis

The APM Guide describes project control through the metaphor of a bicycle trip. But how does BIM (Building Information Modelling) change the processes of the rider both before setting off, and once on the road? Drawing on live project examples the impact and opportunity of BIM on project control processes will be explored.

### Bio

Adrian Malone is a Director at Faithful +Gould, Atkins Group, with responsibility for BIM and Knowledge Management and has 20 years' experience working in the construction industry. Adrian is a member of the RICS Technology Steering Group, the RICS Global BIM Working Group, and is a RICS Certified BIM Manager. Adrian first gained an understanding of BIM between 2005-2008 whilst leading a works package within a four year EU research project on industrialised construction involving 23 partners across 9 countries where BIM was being exploited by consortium members in northern Europe. Immediately recognising the potential of BIM, Adrian has strongly advocated its adoption since. Adrian leads Faithful +Gould's internal BIM working group and represents Faithful+Gould on the Atkins Global BIM Corporate Strategy Team.

Adrian is a founding committee member of the APM (Association for Project Management) Knowledge SIG (Specific Interest Group). He speaks regularly at conferences and industry events on topics which include BIM, social business, knowledge management and innovation.

## Embedding best practice processes and automation within your project teams



T5  
14:45 - 15:30  
Champions Suite

**Gero Renker**  
Co-founder and Director of Enterprise Project Management, Program Framework, UK

### Topic Synopsis

Creating efficient processes speeds up any organisation. It is now possible to build and scale sophisticated processes to automate some business processes with ease. Workflow with best practice empowers your project teams to stay productive wherever they are located and allows them to work on a range of devices. Gero Renker will share his knowledge of the innovative ways clients across a broad range of industries are adding power and manageability to their organisations.

### Bio

Gero Renker is a co-founder and director of Enterprise Project Management specialist, Program Framework. He has many years' experience as a project consultant and works with organisations of all sizes across all sectors in designing and implementing project management solutions. As a Microsoft technical specialist he also advises and works with the Microsoft Project team and is a regular speaker at conferences and seminars.

## Managing NEC3 contracts and the Associated Programme



W5  
14:45 - 15:30  
Dial Square Suite

**Glenn Hide**  
BuiltIntelligence

### Topic Synopsis

Traditionally many Contractors (and even Employers) see following the contract or being contractual as a very negative. The NEC3 suite of contracts command a different approach and this session will explore the benefits of being contractual, and how it will help both Parties to manage their project and understand exactly where they both are in terms of liability throughout their project. A key aspect of this is approach to the management of regular revised programmes, which compared to other forms of contract have a much higher contractual significance under NEC3.

### Bio

As well as running his own well established consultancy (GMH Planning Ltd) Glenn Hide is now a director with BuiltIntelligence. Glenn has presented on aspects of the contract at various national conferences, and had published a number of articles for the ICE Procurement, Management and Law publication and the NEC user-group newsletter. Having exclusively used the NEC form of contracts for the past 15 years he offers insight and practical advice on how users within the industry should understand and maximise the effectiveness of the contract on their projects/businesses.

BuiltIntelligence provides independent collaboratively sourced NEC3 training, knowhow and consultancy services using a collaborative model and technology as enablers to deliver more affordable, accessible and compliant services.

Built Intelligence features their NEC3 eLearning academy, which has over 34 modular online courses (and growing) arranged into real world 'learning adventures' around common tasks such as preparing compensation events, programme, early warnings and payments.

# Detailed Agenda

## Cost Estimate Risk Analysis: For Capital Projects and Maintenance Turnarounds



**M6**  
15:45 - 16:30  
Royal Oak Suite

### Steve Jewell

Practice Leader, Risk Management - Capital Projects at Asset Performance Networks, UK

## Aligning Corporate and Project Stakeholders with Safran and SAP



**T6**  
15:45 - 16:30  
Champions Suite

### Richard Wood

Safran VP of International Development

## Constructive Acceleration - A Global Tour



**W6**  
15:45 - 16:30  
Dial Square Suite

### Jim G Zack Jr

Executive Director, Navigant Consulting, USA

### Topic Synopsis

Once a project or a turnaround team has developed a cost estimate, they are usually required to assign an accuracy range to the estimate and calculate the contingency. Some teams take a simplistic view that if the design package has been developed to a certain standard or class, then the accuracy range can be assigned according to common rules of thumb. However, this route can bypass the requirement to calculate contingency, and it looks at only the "systemic" uncertainty in the estimate, while ignoring any "project specific" uncertainty and risk. In addition, copious evidence over the past 30 years shows that, if left unguided, teams are generally over-optimistic and hence underestimate the contingency required and assign too tight an accuracy range. If we look at the common methodologies used by teams, there are a number of common misconceptions and errors that contribute to this under-estimation.

### Bio

Steve Jewell is the Risk Management Practice Leader for Asset Performance Networks. Steve has over 38 years of experience in the oil and gas sector, of which more than 20 years has been spent in managing risk. He has implemented risk management at project, business and corporate levels. This work has included the development and implementation of risk policy and procedures, development & use of risk tools (risk identification and risk registers), facilitation of risk workshops and coaching / mentoring of teams. Prior to joining AP-Networks, Steve was Senior Risk Advisor at BP. In that role, he led a team that provided risk management guidance to teams across all businesses and facilitated risk workshops for BP's mega projects. Prior to that Steve spent over 20 years on upstream and downstream projects, with 10 years in an assurance role supporting the Chief Engineer by reviewing cost estimates and schedules and running cost and schedule risk analysis in support of project sanction.

### Topic Synopsis

Safran shows how, in collaboration with SAP, all stakeholders in the design and delivery of Capital Projects can be successfully aligned behind a single strategy and governance process.

### Bio

Mr. Wood is a specialist in Project Controls design and implementation for asset intensive industries, with additional experience in IT Governance. Currently VP for International Development at Safran, Mr. Wood has a vision for closing the gap between 'just effective' project controls and 'best practice' process and technology adoption. In his long history with Oracle Corporation and now Safran, Mr. Wood has successfully mentored clients in adopting best-in-class technology solutions and advanced project controls practice in the Oil & Gas, Utilities, Engineering & Construction, and Public Infrastructure sectors.

### Topic Synopsis

Constructive acceleration is a well recognised claim in the United States. The Federal Government's Boards of Contract Appeals long ago created this claim and established the basic rules of entitlement concerning this type of claim. Thus, U.S. based contractors know what must be documented in order to recover in such situations. But when U.S. contractors are working outside the U.S. and are faced with this sort of situation, can they recover in arbitration or litigation in other jurisdictions? This paper examines constructive acceleration in various legal jurisdictions (both common law and civil law) around the world to determine whether a contractor is able to use this type of claim to recover damages.

### Bio

James G. Zack, Jr. is the Executive Director of the Navigant Construction Forum. The Forum strives to be the construction industry's resource for thought leadership and best practices on avoidance and resolution of construction project disputes globally. Formerly he was the Executive Director, Corporate Claims Management, Fluor Corporation, one of the world's largest publicly-owned engineering, procurement, construction and maintenance (EPCM) contractors.

Mr. Zack was previously Vice President of PinnacleOne and the Executive Director of the PinnacleOne Institute and a Senior Construction Claims Consultant for CH2M HILL, Inc. Mr. Zack has, for more than 40 years, worked on both private and public projects. In the construction claims field, he is a recognized and published expert in mitigation, analysis and resolution or defense of construction claims and disputes.

# Detailed Agenda

## Productive Forecasting



M7  
17:00 - 17:45  
Royal Oak Suite

### Mike Younger

Head of Project Services,  
Jacobs Corp., UK

#### Topic Synopsis

Everyday Project Controls people can spend most of their time looking at the past rather than the future; this presentation challenges this and asks should we not be looking forward more.

It shows ways Earned Value can be used to start to predict future performance by reviewing productivity against plan. This is a powerful tool which is applicable across all industries and all phases of projects and is easy to calculate based on data collected by us each month. This presentation challenges this and asks the question why are we not doing this so we can start to look forward and be more proactive in our control of projects?

The second part of this presentation looks at bulk material forecasting and challenges.

#### Bio

Mike has been in Oil and Gas now for over 35 years since becoming an apprentice at the age of 16. He spent the first 8 years completing day release study to achieve an HNC and then a Bachelor's Degree in Mechanical Engineering. He has spent all of these years in Project controls on the Contractors design side, starting in Cost Control and moving into project Controls management at the turn of the century. He has been the corporate head of project controls at KBR and more recently at Jacobs. He has a very balanced CV with half his career in the offshore sector, including 3 years working on North Sea Gas platform as well as onshore work. He has lived overseas in 6 countries and worked on some of the biggest projects across the world during his career. He has also worked on projects starting at just a preconcept study right through to operations of the plant, on one such project, the Learn Alpha Compression job, he saw this through all stages over a 5 year period working in 3 different locations.

## The computer age and estimating - don't forget the fundamentals



T7  
17:00 - 17:45  
Champions Suite

### Alan Chilcott

CCP, MACostE, B.Tech Chem Eng.  
Assessor and Course Presenter/ Trainer,  
TASC

#### Topic Synopsis

Over recent decades there has been very substantial development in project-related software covering the main elements of estimating/budgeting, planning/scheduling and progress measurement. Whilst this has many obvious advantages the need for the users of such software to be thoroughly grounded in the basic methodologies, as well understanding the specifics of the data bases and calculations carried out by the software, are considered to be essential to avoid possible misuse which could negatively affect the project outcome. Focussing on the estimating function, the applicable "fundamentals" are described in the context of a training course which has been designed to meet this need.

#### Bio

Alan is a currently engaged as an Assessor for the Qualification Credit Framework (QCF) programme in Project Controls and as a course Presenter/Trainer. He has enjoyed a long career during which he has gained a wealth of experience in the cost engineering/project management/project controls field, commencing as a graduate chemical engineer and moving into a project management role with a major chemical/petrochemical construction company both locally and overseas. Following this he was responsible for preparing capital and operating cost estimates and economic evaluations for metallurgical projects for a South African quasi-government organisation. In semi-retirement Alan formally qualified as a Certified Cost Professional through the AACE International. This opened the way to his being employed as a course Presenter/Trainer for cost engineering courses aimed at preparing candidates for such qualifications.

## Project Delivery , growth and collaboration



W7  
17:00 - 17:45  
Dial Square Suite

### Ken Phillips

Planning Lead at Amec UK

#### Topic Synopsis

Many organisations are developing strategies and encouraging collaboration to allow their employees, customers and partners to intelligently connect and interact and improve Project Delivery and Growth. How project organisations adapt to change, quickly and effectively, which is at the core of Agile work flows and potential to impact Major Infrastructure Projects while developing strategies and encouraging collaboration to allow their employees, customers and partners to intelligently connect and interact to improve successful Project Delivery and Growth and collaboration on Major Projects. Learning from failure, collaborative planning and scheduling how agile business delivery has assisted Major Infrastructure Projects in UK.

#### Bio

Ken Phillips is a Project Controls Professional / Lead Planning Engineer who has worked in projects for many industries including infrastructure, marine facilities, oil & gas, refineries, petrochemicals, chemical, nuclear, conventional power, pharmaceuticals and wastewater. His experience includes all phases of engineering and design and extends through construction and commissioning. Familiar with a wide range of project controls, planning software and planning techniques. Over 15 years experience of Middle East Projects and International Projects.

# Technical Papers

## Schedule Risk Analysis; Are You Ready For It?

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We help deliver complex programmes through the integration of programme management and systems engineering. This means that you maintain a clear picture of your goals and how they are being realised, which builds the coherence you need to make informed decisions.

### About the author

The author is a project and programme controls consultant with BMT Hi-Q Sigma. He is currently working with clients to introduce and maintain a robust and appropriate project control system within a complex defence programme. His experience in schedule and risk management allows him to assure clients of how to deliver the best inputs to the SRA modelling process so that outputs are well founded and credible. His background is firmly within the defence sector, and has worked on some of the UK's largest and most complex defence projects.

**Paper subject:** Project Risk Management and Forensic Schedule Analysis

### Disclaimer

I hereby declare that the content of this paper does not infringe any copyrights and is owned by the author.



Signed: .....  
T. Olden

### Abstract

This paper raises concerns that the application of schedule risk analysis (SRA) may sometimes be merely a means to an end rather than as an aid to allow projects to make well founded decisions. The paper is not looking to describe the SRA process, or to detail the benefits of SRA. Instead the paper seeks to outline key questions a project manager should ask themselves about their project and organisation before undertaking an SRA.

The objective is to ensure that the benefits of SRA are fully realised and that its potential weaknesses are understood. The key themes highlighted through the paper are the need for project managers to assure themselves that the process is impartial, that it has been applied to an appropriate degree and that they are confident the outcomes can be used to take decisive action for the good of the organisation.

The key message is that without a solid foundation an SRA is unstable and its value cannot be fully exploited.

### Introduction

Take your schedule, drop it into a Monte Carlo engine, apply some risks, press the button and in a couple of turns of the egg timer you have a set of confidence dates, some distribution curves and even a tornado chart or two. If you don't get quite the answer you were looking for you can alter a maximum duration here, a risk likelihood percentage there and press the button again. Eventually you'll get a result that supports your business case and doesn't attract too many difficult questions. That's the aim of SRA right? It's a means to an end.

It's pretty obvious that the previous paragraph was designed to provoke the response "No! Of course that's not right". But be honest, how often is schedule risk analysis (SRA) completely unconstrained and unbiased, based on credible and technically accurate inputs and analysed by an experienced risk practitioner? Moreover when have you used the results to inform decisions on budgets, resource allocations and even the viability of the project?

Regardless of the reason for undertaking SRA, every project manager must consider whether they and their project are ready to go through the unbiased process required to produce a beneficial SRA output and to accept the results.

This paper doesn't intend to discuss the benefits and process involved in undertaking an SRA, as these are already well documented. Instead the paper seeks to ask the question 'are you REALLY ready for SRA?' by examining the true components of a robust analysis and the potential impact of compromising any one of them.

However, before you read on it must be stressed that this paper isn't designed to turn you away from the idea of utilising SRA, as it's a useful part of a project manager's arsenal. The paper aims to give you a greater appreciation of how to plan for and conduct a quality SRA in order to gain the most benefit from it.

### Components of SRA

It's a common misconception that if you have a schedule and you have a risk register then you have all the components required to undertake an SRA. The fact of the matter is that there are a number other components that must be in place before an SRA will be close to meaningful. These components can be broadly grouped into three perspectives;



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Inputs	Appropriate unbiased and credible data required for a realistic SRA to be run.
Enablers	Attitude of the organisation, governance, required skills, knowledge and time to undertake an SRA.
Outputs	Transforming the accepted outputs of the SRA into meaningful action.

It is the sum of all of these components that make up the SRA. The analogy of a house of cards is quite apt, if any one of these components is absent or has been compromised then the hard work involved in putting the individual cards together will be in vain. You will be left with a pile of cards with nothing meaningful to show for all your effort, or even worse, your house of cards will just about stand up, but on extremely weak foundations that may lead to key decisions being taken based on misleading analysis.

The following sections explore each of the perspectives above and provide the real questions you should be asking yourself to ensure you are ready to run an SRA.

## Inputs

The inputs to an SRA are its foundations, if these aren't solid then the outputs, analysis and decisions that come from the SRA will be baseless. I'm sure you've all heard of the phrase "Rubbish in; Rubbish Out", or more specifically in the case of SRA, it will probably be "Bias in; Bias out".

Before considering whether to undertake an SRA you as the project manager not only need to be assured that the inputs are well founded, but also, that you understand what it is you want to achieve by undertaking an SRA.

The following four questions hope to prompt that thought process.

### 1) Do you fully understand the purpose of running this SRA?

Reasons such as; "to get the senior management off my back", "because we have to convince the scrutiny department or client that we know what we're doing" or "we need to show that we are going to meet our deadline" are not good reasons for undertaking an SRA and indicate that the benefits of SRA are perhaps not fully understood.

Understanding the context, stakeholder expectations and having a clear understanding of the decisions your SRA is intended to support, will make it easier to gather the necessary inputs and "sell" the results to the stakeholders. There is no point going through the SRA process only to provide an analysis that fails to answer the questions you and your stakeholders wanting answers for.

Understanding the purpose also allows you to focus the SRA on particular areas of the project that are of interest. For instance, if the project is 20 years in duration, but stakeholders are only interested in the likelihood of achieving the first deliverable after two years there is no point in developing a risk network for the entire project.

If you can't answer the question "what is the purpose of running this SRA?" with a valid, focused and unambiguous reason, such as; "we are trying to identify the phase in our project that is most likely to affect the likelihood of meeting our contract deadline" or "the penalty clauses in our contract mean that missing our deadlines could prove very costly – how much money should we be spending up front to mitigate risk and protect our profit", then there is no foundation to run an SRA.

### 2) Do you have estimates free of bias, obtained from multiple sources and which are considered credible?

The answer to the questions; "how do you know whether your estimates are free from bias and are credible" is that you can't, but you can take action to reduce bias and increase the credibility of your estimates.

Only if you have consulted as many people as is practical, with the expertise and experience required, on an individual basis (to avoid 'groupthink'), can you say for certain that your estimates are as free of bias as possible and therefore, as credible as possible.

As tempting as it is to believe, putting poor estimates through a modelling tool does not make them any more accurate and certainly does not validate them. Referring back to the 'House of Cards' analogy, if the foundations are weak, you cannot be sure that the structure they are supporting will not collapse under even the lightest challenge.

### 3) Does your risk network contain sound and tested logic?

If the risk network is constructed using any scheduling technique other than left to right with complete and free flowing logic, the answer to the above question is 'no' and the SRA will fail to accurately portray the impacts of estimating uncertainty and event risk.

The risk network forms the backbone of the SRA. Regardless of the level of the risk network and the tasks it includes, it must allow delays to honestly and fully propagate through without interference (i.e. constraints, lags) to provide a meaningful output.

# Technical Papers

## **4) Have all assumptions upon which the risk model is based been clearly articulated and documented?**

Any analysis is only as good as the assumptions with which it is presented. It's highly likely that some information needed to undertake an accurate SRA is either not available or is unstable at the time required. In these cases planning assumptions should be made in order to complete the SRA.

These need to be documented to allow you to understand the results of the SRA when revisiting it at a future date. If the answer to the above question is "no" then revisit it to understand what factors may invalidate the SRA if they were to change in the future.

Remember that an SRA will never provide 'the answer'. Even the best quality SRA will never end with a statement saying, "the answer is X". Project management, as with life, is never that cut and dry; and it is part of the responsibility of the analyst to ensure that the results they present are not divorced from the assumptions and context with which the analysis was carried out.

It is clear that to ensure the results of the SRA are credible and provide value, time must be taken upfront to ensure that the inputs are meaningful and well thought out. Without credible inputs to the SRA, the results should not be trusted.

### **Enablers**

Enablers are the things that allow a successful SRA to take place, free of interference, at the appropriate level and with the right analysis to answer the required questions.

This paper is focusing on organisational enablers such as; knowledge, availability of resources, appropriate governance and organisational maturity.

The following questions are intended to challenge whether you are in the position to make the most of the SRA and its outcomes. If you're not, you must ask "why am I doing it?"

## **1) Do you have the right level of knowledge, experience and impartiality within the organisation to properly analyse the SRA results?**

It's not too difficult to throw a few risks together with a high level schedule and click a button. Similarly it's not hard to read results from a graph. However, would you or any of your team be comfortable explaining to senior management the detailed results of an SRA, the context and assumptions that underpin them, how they were achieved and what they do (and importantly, don't) tell you about the project?

If you want to get valid and impartial results that provide a meaningful insight to the project then you need people with specialist competence, training and experience. If you expect to run a meaningful SRA without the specialist skills, you run the risk of making decisions about your project based on un-informed analysis.

## **2) Have you allowed enough time to fully engage with the SRA process, analyse the results and put actions in place?**

Running an SRA is not a simple process; from experience an SRA invariably takes longer than you initially expect. Rushing it can result in poor quality analysis and can invalidate the whole outcome.

An important point to remember is that SRA needs to be done to an appropriate level of granularity and should be iterative. SRA takes time and depending on the reasons for undertaking an SRA it may not be necessary to undertake it on the entire project. Consider what is appropriate to you and weigh the costs, time and effort against the potential benefits.

## **3) Are you opened minded about the outcome and unconstrained by pre-conception?**

This question speaks for itself; if you already know the answer you want the SRA to provide, aren't open to alternatives and are willing to manipulate the model to get the answer you want, then it's a fairly futile exercise. SRA is not flawless; referring back to the second sentence of the paper;

*"If you don't get quite the answer you were looking for you can alter a maximum duration here, a risk likelihood percentage there and press the button again"*

Doing this defeats the object of the SRA and invalidates the process, analysis and any decisions made based on the outputs.

It's strongly recommended that an impartial third party is utilised to assure that the process is undertaken correctly, regardless of the result. If you are the project manager or senior stakeholder commissioning an SRA then it is your responsibility to ensure that the analyst is not unduly influenced by yourself or other stakeholders. If you think you know what you want the 'answer' to be, then don't tell your analyst!

It is clear that enablers are a key aspect of running an SRA. Without aspects such as the knowledge, time and right intention of running an SRA, results of worth and value are impossible.

# Technical Papers

## Outputs

Outputs in the context of this paper are not referring to the technical analysis or various graphs that an SRA produces, these are produced regardless of whether the SRA is based on solid foundations or not. Instead, this paper is looking at the actions of the organisation and project team as a result of the SRA outputs.

The three simple questions that you should ask yourself with regard to outputs may be difficult to answer. However, they need to be considered.

### **1) Is your SRA analyst independent and free of un-due influence from the project team or senior management?**

If the answer is no, how can you trust the results and base decisions on them?

To ensure credible, valid and impartial outputs the operator needs to be independent of the project team or senior management. Without this you cannot assure yourself or your stakeholders that the outputs have been free of any influence that could have altered the results.

### **2) Is the governance and culture in your organisation prepared to understand and act upon the outcomes of the SRA?**

"Prepared to understand", what does this mean? Fundamentally, will you or your senior management accept the results of the SRA and try not to influence them to make a political point, or to ensure the continuation of the project. What other information will you be taking into account when considering the results?

As for "acting"; is the organisation ready to make the decisions that a SRA may highlight? For instance; "where shall we spend the £100K budget for risk mitigation?" or more contentiously, "should we cancel this project?"

It's also important to remember that SRA is just one of many tools used to inform decisions. There is nothing inherently wrong with basing decisions on the project manager's experience, or 'gut instinct', but SRA can provide the evidence based analysis and perspective to support your gut instinct or indeed challenge it. SRA is another tool for the armoury, and should be used as such – not the magic bullet, but extra ammunition!

If the organisation is not mature enough to accept an outcome or ready to take action then ask why are you doing an SRA, what is the benefit to the organisation and the project?

### **3) Do you have the time and resources to act on the outputs of the SRA?**

This question goes hand in hand with its predecessor. Whilst you may have the intention to act, depending on what may be required, do you have the time or resource to actually do it.

Identifying the reasons for undertaking the SRA, and conducting the analysis at an appropriate level, is key. If resources are not available, expectations must be managed at the outset of the SRA process so that the reasons for undertaking the SRA are not undermined.

The actions of an organisation following the SRA are fundamental to success. If no action will be taken following the SRA, what value has it added? The effort put into the SRA must be matched by the effort put into the results to ensure that the right direction is taken by the organisation or project following the results.

## Finally

Looking back at the question the paper is trying to answer, 'are you REALLY ready for SRA?', put simply; if you can't answer 'yes' to all of the questions asked through the paper, and compiled in table 1, then realistically you're not ready to get the best from an SRA.

However, before you think, "well I just won't bother then, as it all seems a bit too hard to do properly", everything discussed can be overcome or managed. The key is to understand the weaknesses of the SRA to ensure you get the most benefit, or tailor the process to an appropriate level.

The key points to remember are that in order to get the best from SRA you must:

- Understand the reasons for undertaking an SRA
- Assure yourself that the process is impartial and unbiased
- Apply it at an appropriate level
- Be confident that the outcomes can be used to take decisive action for the good of the organisation.

SRA is an extremely powerful tool that can provide huge benefit to projects and organisations when 'done right'. So now, ask yourself, are you REALLY ready for SRA?

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**Table 1: "The Complete SRA Readiness Quiz"**

	<b>Desired answer</b>
Do you fully understand the purpose of running this SRA?	Yes
Do you have estimates free of bias, obtained from multiple sources and which are considered credible?	Yes
Does your risk network contain sound and tested logic?	Yes
Have all assumptions upon which the risk model is based been clearly articulated and documented?	Yes
Do you have the right level of knowledge, experience and impartiality within the organisation to properly analyse the SRA results?	Yes
Have you allowed enough time to fully engage with the SRA process, analyse the results and put actions in place?	Yes
Are you opened minded about the outcome and unconstrained by pre-conception?	Yes
Is your SRA analyst independent and free of un-due influence from the project team or senior management?	Yes
Is the governance and culture in your organisation prepared to understand and act upon the outcomes of the SRA?	Yes
Do you have the time and resources to act on the outputs of the SRA?	Yes, to an appropriate degree

## **Acknowledgements**

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Georgina Jones – BMT Hi-Q Sigma

# Technical Papers

## Progress, Position, Prediction - The key to completing projects on time

David Bordoli BSc MSc FCIQB MAPM ACIARB, Driver Group

### Author Profile

David has over 30 years in the construction industry specialising in planning and scheduling, initially with contractors and latterly as a consultant focusing on forensic delay analysis. David is academically and professionally qualified and is the author of numerous high quality papers. He was awarded an MSc degree with distinction for his work on 'The simulation of construction project delays using network techniques', the method of analysis now known as 'Time Impact Analysis'. His book, 'A Handbook for Construction Planning and Scheduling', co-authored with Andrew Baldwin, was published by Wiley Blackwell in May 2014. Most recently he has been engaged as an expert on major projects in South Africa and China.

### Key Words

Progress. Position. Forecast. Earned value. Change. Linear regression. S-curve. Schedule.

### Abstract

Current methods for assessing activity progress, calculating project position and forecasting project completion (including the use of earned value analysis) are examined in this paper. The disadvantages of current forecasting methods are discussed with special reference to single data point extrapolation and the difficulty for non-specialists in analysing s-curves. A different method of forecasting project completion using simple linear regression and time series analysis is proposed which has real practical applications for project managers and allows them to easily and rapidly produce position and forecast data in a format that is understood by layman and specialist.

### Introduction

The UK Construction Industry does not have a good record for completing projects on time. Constructing Excellence's data from its 2012 report <sup>1</sup> (the latest available) shows that the actual out-turn time taken for the construction phase of projects compared with the length of time agreed at the start of that phase dropped sharply in 2012, with only 42% of projects delivered on time or better, compared with 60% the year before. Whilst this is the first time since 2000 that the KPI was below 50% the data shows that, on average, less than 40% of projects finish on time, Figure 1.

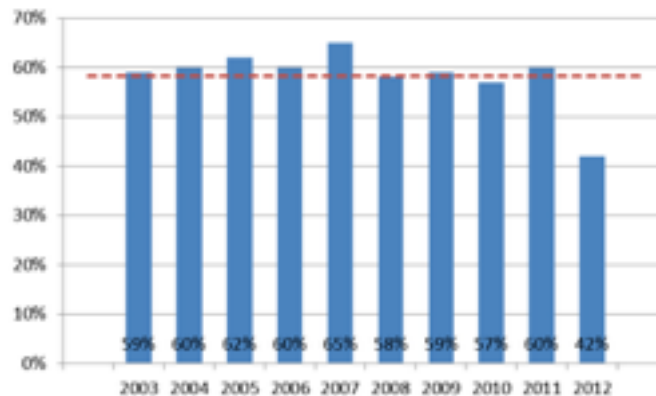


Figure 1. Predictability Time - Construction

The production of a project schedule is the first step in project control. In some cases, particularly on undemanding and straightforward projects, this initial planning and programming is sufficient and the project manager will be able to determine the status of the project without rigorous examination. More often schedules are required to assist with the active management of time by regular monitoring, examination and modification. Active management of time comprises three steps; Progress, Position, and Prediction, these are all relative to a point in time when the measurements or calculation are made; 'time now'. Without accurate measurement of progress it is not possible to establish the position of the project and without knowing the current status of the project, predictions about the completion of the project are likely to be little more than guesswork. Without knowing when the project is likely to be complete it is impossible to determine what action must be taken to bring in the project on time.

### Current Techniques

#### Progress – how much has been done

This is reasonably straightforward and usually involves assessment or calculation of the percentage of work completed on individual schedule activities <sup>2</sup>. Progress can also be attributed to the project as a whole but unless the project is relatively simple a single measure of how much of the project is complete is somewhat superficial.

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## Position – what is the current status

Position is usually stated as time ahead, on schedule or time behind and relates to an individual activity or the project as a whole is a comparison of where the activity, or project, is compared to where it was planned to be.

For a single activity, assessment or calculation of position is also relatively straightforward. To calculate activity position:

if  $S \leq TN \leq F$ , then if  $(\% < 100, P = S + (D \times \%) - TN, \text{ else } P = 0)$ , else  
if  $S \leq TN \geq F$ , then  $P = S + (D \times \%) - TN$ , else  
if  $S \geq TN$ , then if  $(\% > 0, P = S + (D \times \%) - TN, \text{ else } P = 0)$

Where: P is the activity position,  
S is the planned start of the activity,  
F is the planned finish of the activity,  
TN is time now,  
D is the planned duration of the activity, and  
% is the percentage complete of the activity at time now.

However, for a single activity, position is more readily demonstrated graphically using the bar chart 'drop line' method <sup>3</sup> (see figure 2).

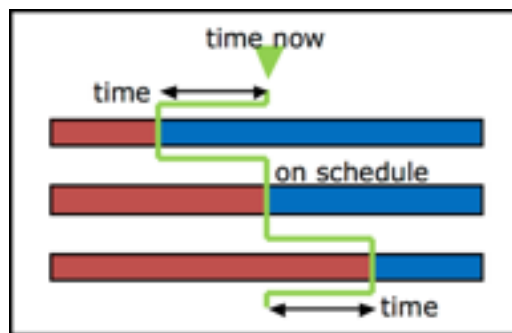


Figure 2. Drop line activity progress and position

Determining the project position (or project status) accurately is more difficult. Many project managers will use their skill, judgement and experience to assess the project position. However, such visceral and subjective techniques are open to suggestion of bias and manipulation for commercial or other ends.

A number of objective techniques have been developed:

- **Averaging** - This method averages the position of all the activities that are ahead or behind schedule. Although simple and apparently reasonable this method is mathematically unsound.
- **Planned Progress Monitoring (PPM)** <sup>4</sup> - This method compares the planned work content (based on activity duration) with that achieved. This method does not depend on the schedule being a critical path network and is predominately the underlying method adopted to 'roll up' progress in summary and expanded type bars of project management software.
- **Critical Path Methods** - When the progressed project is rescheduled with the variance in the end date of the project can be interpreted as the project position. This method depends on a fully linked and logical network.
- **Earned Value Analysis (EVA)** <sup>5</sup> - The parameter SV (scheduled variance) is a measure of the current status of the project. This is similar to standard cash flow analysis; income -v- expenditure or cash weighted PPM.

## Prediction – when will the project end

Predicting is the estimation or forecasting of some future event or condition of the project as a result of the study and analysis of available data on the basis of observation, experience or scientific reason. Generally this will relate to a project milestone and particularly a forecast of when the project will be complete.

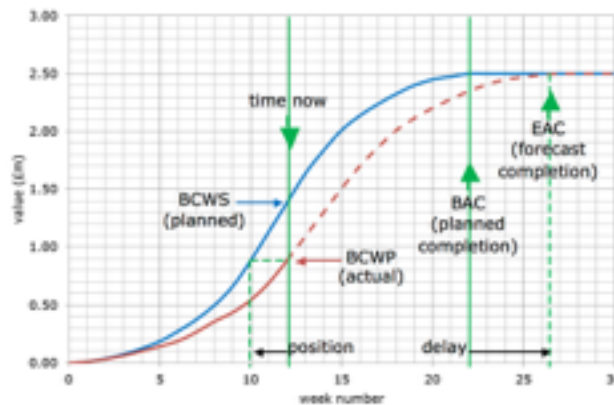
By its nature the prediction of future events with any degree of accuracy is difficult. Project managers tend to rely on their experience and analysis based upon the current position of the project and with the assistance of the project schedule will envisage, or more formally reassess, the schedule for the remaining work. If the reason for delay in the schedule was merely unrealistic durations and sequences then updating and amending the schedule to predict the completion date may be viable. Unfortunately the time taken to complete activities generally conforms to Parkinson's Law <sup>6</sup> and the Student Syndrome <sup>7</sup> so, unless the underlying causes of delay are confronted, there is inherent risk of overrun of the reassessed schedule too.

The result of analysing a critical path network taking into account current progress is often erroneously referred to as a forecast of completion. For instance, where the project is in delay the rescheduled end date of the project would be delayed, this will only be a forecast of the completion date if the uncompleted remaining work were to be carried out in accordance with the schedule. It is more likely that if past work was not carried out in accordance with the schedule then, unless something changes, nor would future work. As stated previously the result of rescheduling a network taking account of current progress is a measure of the project position.

# Technical Papers

EVA attempts to formalise the forecasting of completion of projects using the parameter EAC (Estimate at Completion) <sup>8</sup>. The unnecessarily complex acronyms render the technique virtually unusable for all but the ardent enthusiast. In relation to time alone the technique can be simplified using the rate of progress to date and the time outstanding on the original schedule; for example, see Figure 3.

Planned completion date = 22.0 (BACt)  
 Time now = 12.0 (BCWSt)  
 Current position = 10.0 (BCWPt)  
 Rate of Progress =  $10.0 / 12.0 = 0.83$  (SPI)  
 Time not yet completed =  $22.0 - 10.00 = 12.0$   
 Forecast time to complete =  $12.0 / 0.83 = 14.5$  (ETCt)  
 Forecast completion date =  $12.0 + 14.5 = 26.5$  (EACt)



**Figure 3. Forecast completion using Earned Value Analysis**

Whilst the estimated completion date can be calculated, plotting of the remaining forecast to completion curve is problematic, but without it, it is difficult to envisage the remaining progress of the project and to determine if future work is proceeding to the forecast plan. In his booklet 'EVA in the UK' <sup>9</sup>, Steve Wake says:

*The estimates to complete can be plotted (or hand-drawn by "experienced professionals"). ...*

*The prediction of potential EACs (Estimates at Completion) has become increasingly accurate by using performance statistics from similar projects. These statistics become templates that are overlaid onto the existing cost curves of a project and provide an independent and objective estimate of the final cost and completion date. Something that everyone is interested in.*

Blythe and Kaka<sup>10</sup> take a different view and appear to suggest that advanced mathematical modelling is required (or at least beyond the capabilities of most project managers) and that the accuracy of the models is questionable:

*There have been many attempts in the past to develop cash flow forecasting models. They were mainly part of more comprehensive models aimed at assisting contractors or clients forecast their cash flow on an individual project level or on a company level. The majority of these models were based on the idea of developing standard S-curves to represent the running value or cost of different types of construction projects. Typically this was achieved by collecting data relating to the monthly valuations and the projects' general characteristics. These projects would then be classified and distributed into groups and average S-curves would then be fitted on the individual groups. Several mathematical models were used to fit the S-curves (e.g. alpha-beta cubic equation, Weibull function, DHSS model etc.). These models could be used, given that the total value and duration of the projects to be constructed are known, to forecast the cumulative monthly (or at any other time interval), value/cost of that project. The accuracy of these previous models is in question.*

Using PPM similar shaped graphs to EVA's BCWS and ACWP for planned progress and actual/as-built progress are generated. Whilst PPM is a useful method for determining the position of a project the s-curves that are typically produced are not easy for most practitioners to assimilate and to use for forecasting, see Figure 4.

Extrapolating the rate of progress, planned compared to actual at 'time now' can be used to predict the project completion date without the need for considering EVA or PPM. The only data require is the original project duration (D), the project position (P) and the 'time now' date (TN). The forecast completion date is:

$$\text{Completion} = D \times TN / P$$

$$\text{Using the previous example:} = 22 \times 12 / 10 = 26.4$$

# Technical Papers

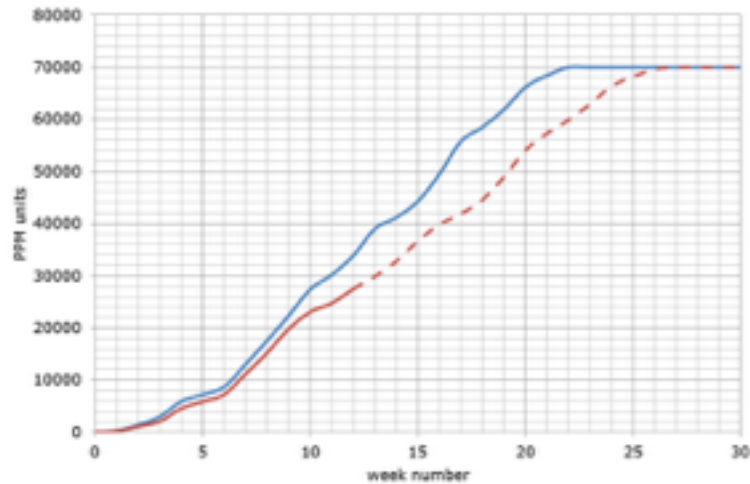


Figure 4. PPM - planned, actual and forecast curves

## The Proposed Method – Simple Linear Regression

Statistical analysis of project data has, up to recently, been the preserve of the financial analysts, be they corporate accountants or project accountants<sup>11</sup>. The data produced, when graphed, tends to resemble an s-curve. As described previously, in connection to EVA, it is not easy to estimate the path of a partially completed curve. It is possible, theoretically at least, to assign a mathematical formula to most curves but these can be extremely complicated (at least for the layman) and there is no certainty as to the shape, and hence formula, of that a predicted curve will, or should take.

The data for the graph at Figure 3 was based on SPI of 0.8 and further randomized on a monthly basis between 80% and 120% to model variances in progress. The graph at Figure 5 illustrates the difference between the forecast data (from Figure 3) and the modelled 'actual' data. The forecast completion is 27.6 months which is very close to 27.5 months that would be expected for a 22 month project (22/0.8). Whilst this apparent accuracy is as much to do with the coincidence randomness of the data it illustrates the primary flaw in SPI type forecasts that they use a single data point as the basis for extrapolation rather than a longer term trend.

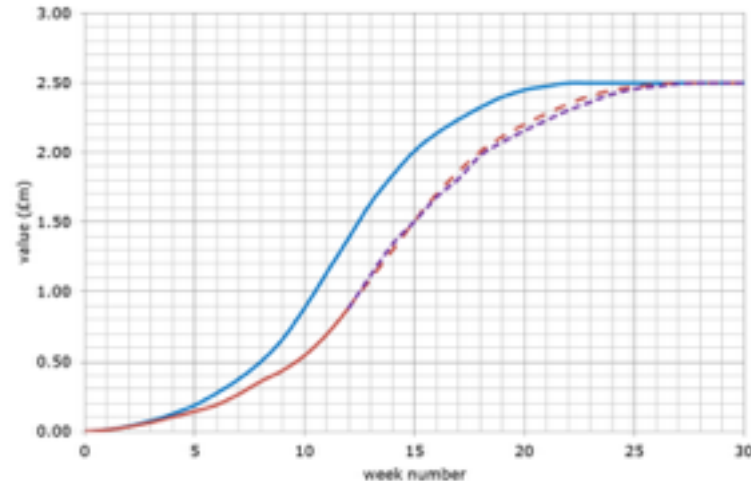


Figure 5. EVA - forecast and actual

To overcome this weakness and the limitations of projecting unsystematic curves the method described below is based upon simple linear regression and time series analysis. Whilst the components of the method are not novel the author is not aware of it being used to forecast project completion, particularly at least in the UK construction and engineering industry.

## The planned model

The position of a project is usually stated as being ahead, on schedule or behind but it can also be stated as the number of schedule weeks achieved. For instance, a project at week 20 which is 2.5 weeks behind schedule can be said to have achieved week 17.5, similarly a project at week 20 that is 2.5 weeks ahead of schedule can be said to have achieved week 22.5. The importance of the proposed method is recognising that for all projects there is a simple straight-line relationship between the planned position of a project and project time such that, for instance, at week 20 the project is planned to have achieved week 20. The planned position line for all projects will be a '45 degree' line which straightens at the project completion date; see Figure 6. In terms of EVA the planned line is similar to the BCWS curve.



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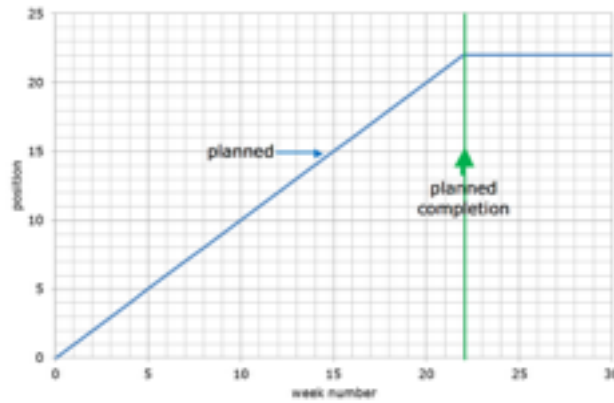


Figure 6. The actual/as-built model

The data for the actual/as-built model (BCWP in EVA parlance) is generated by calculating the project position by whatever method is appropriate as outlined above. It is not recommended that different methods of determining the project position are used for each period but it may be good practice to generate multiple datasets based on different methods of calculation which then may give a range of estimates of project position.

The actual/as-built position data can then be plotted against the planned data; see Figure 7. As the planned model is based on a straight line it is easier to appreciate the deviation of the actual position compared to the planned position.

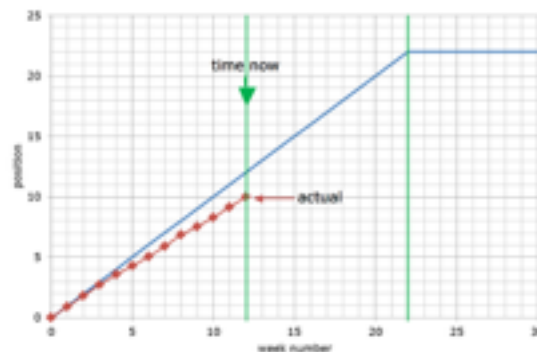


Figure 7. The actual/as-built model

## The forecast model

The forecast of completion is made on the premise that, if nothing changes, if progress carries on in the future as it has in the past, the project completion date will be thus. Previous forecast models have used a single data point; the last measured project position. However trends are not absolute and there is likely to be some waxing and waning, positive and negative deviations from the general trend. Using the last measured progress position may exaggerate or understate the general trend.

As the planned position is based on a linear model it is acceptable to consider that the actual model, unless it is subject to wild fluctuations due to specific delaying events, will also follow a linear trend and hence forecast can be made using simple linear regression which will take account of all the past progress not just the last project position.

Figure 8 shows the simple linear regression line plotted for the actual project positions<sup>12</sup>. The linear equation enables the trend line to be extended to the completion position (month 22) and for the date to be calculated, in this case 26.62 months.

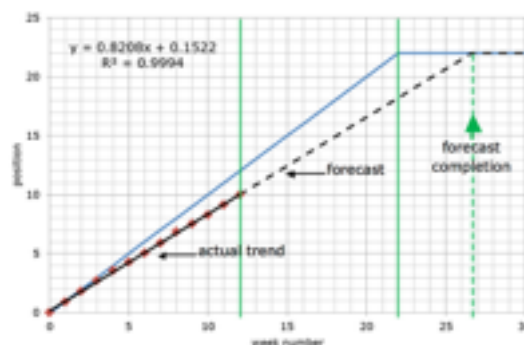


Figure 8. The forecast model

The position trends are easier to assimilate as straight lines and progress and trends, should future performance match past performance, can be readily seen as can changes in progress required if the project is to not lose any further time or to be completed on time, see Figure 9. It is submitted that such trends are not readily accessible using s-curves.

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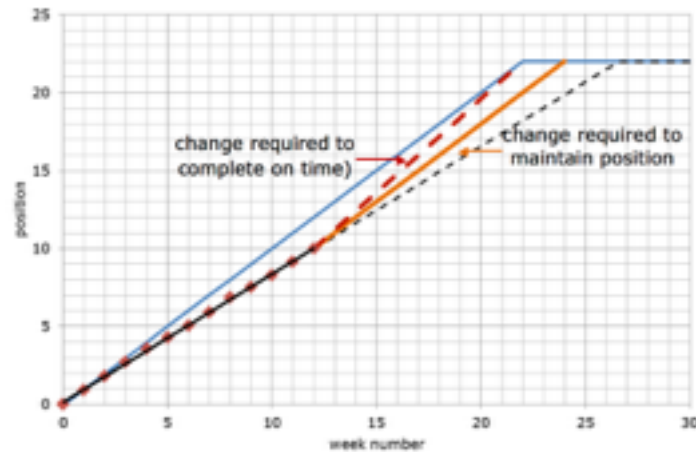


Figure 9. Change required

Most emphasis in this paper has been on projects that are behind schedule. Figure 10 shows typical regression plots for projects that are on schedule and for projects that are ahead of schedule.

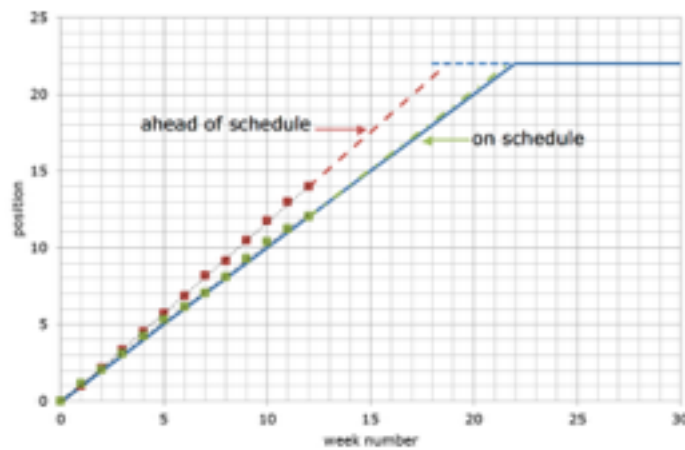


Figure 10. Ahead and on schedule

## Conclusion

Forecasts of completion dates are almost always wrong. Forecasting completion of projects is not about estimating when a project will be complete but more about when it will be complete if progress continues in the future at the same rate that was achieved in the past. Only by knowing what the potential overrun (usually) will be if nothing changes can the project manager determine what needs to be done to bring the project back on schedule. The reason forecasts are wrong is that, hopefully, project managers will have taken steps, with the knowledge of the effects of doing nothing, and have pulled the project around.

Current methods of forecasting completion mostly depend on extrapolating the last known project position to forecast project completion. Earned Value methods also use a single position measure but depend on s-curves to illustrate the work flow. S-curves are difficult to assimilate and difficult to mathematically predict.

The proposed method depends on simple linear regression taking account of all the position data and presenting it in simple straight-line graphs that are more readily understood by non-specialists. Trends are easier to understand and the amount of action to bring the project back on schedule is straightforward to see.

Like all current methods of forecasting, including earned value methods, specific and exceptional delaying events can skew the forecast. Progress trends tend to be influenced by leadership, management, resources, experience and strategy decisions.

## Acknowledgements

Anneka Wilson, Driver Group's Group Marketing Executive has been constant with her help and encouragement even though, like most planners, I have always been behind schedule.

My colleagues at Driver Group; Stephen Lowsley, Keith Strutt, David Wileman, Philip Allington and Janus Botha have provided technical critique of my paper – any errors, however, remain mine.

Dr Chris Chatfield of the Department of Mathematical Sciences at the University of Bath and author of 'The Analysis of Time Series: An Introduction, Sixth Edition' <sup>13</sup>, kindly took time to reply to my emails and responded to my very basic time series questions.

# Technical Papers

- 1 UK Construction Industry KPIs – Industry Performance Report. Constructing Excellence, Glenigan and Department for Business Innovation & Skills (2012), at p.16.
- 2 There are many other measures of progress including time expended on an activity, time remaining on an activity, time required to complete an activity and similar measures weighted by value, resource content and so on. It is usual to assume that progress is a straight-line function of time whereas it is more likely to be a 's-curve'. For short duration activities typically found on project schedules errors from using the straight-line approximation are not significant.
- 3 The drop line, or 'jagged line' method of marking progress involves drawing a vertical line on a barchart at time now. The line deviates to the left or right to coincide with the amount of progress achieved on the activity bars of the programme. Where progress on an activity is less than programmed the jagged line will deviate to the left. Where progress on an activity is as planned the jagged line will remain vertical at time now. Where progress on an activity is greater than planned the jagged line will deviate to the right.
- 4 'PPM Planned Progress Monitoring'. PSA Directorate of Surveying Services (1988).
- 5 Schedule Variance (SV) = Budgeted Cost of Work Performed (BCWP) – Budgeted Cost of Work Scheduled (BCWS). In the author's experience EVA, despite claims made for the technique, has not been readily accepted into the UK construction industry and tends only to be used on major complex projects where the system is mandated. Criticisms of the technique suggest that it is more suitable for resource orientated projects rather than capital orientated projects and that inconsistent time/cost values of construction activities (for instance, high time/cost value process plant installations against low time/cost value landscape works), valuation and payment terms make the technique difficult to apply in its original formulation. Paul Kidston for example, has developed a modified version of the technique based upon the planned and actual human resource content of work. The data collection requirements of the modified technique are not common in the UK construction industry and, as far as the author is aware, activity value/resource content data has not been published. (See 'Controlling Construction Projects Using Earned Value Analysis', Newsletter Spring '05, Planning Engineers Organisation (2005) and at [www.planningengineers.org/information-zone/publications/papers.](http://www.planningengineers.org/information-zone/publications/papers/))
- 6 "Work expands to fill the time available for its completion". C. Northcote Parkinson (1909–1993). From 'Parkinson's Law', Economist (19 November 1955) (and the opening words of 'Parkinson's Law: The Pursuit of Progress', London, John Murray (1958)). If a project is given six months for completion, it will require six months to finish. If the same project is given two years for completion, it will require two years to finish. Two factors are responsible for this phenomenon. First, when a deadline appears to be far off, people work more slowly and put tasks for that project farther down their priority lists. Second, when a large amount of time is available, people will do more unnecessary things on a project than when less time is available.
- 7 Student syndrome from 'Critical Chain', Eliyahu Goldratt. The North River Press (1997) at p.246 and refers to the phenomenon of people leaving a lot of work until the last moment and only fully applying themselves to a task at the last possible moment before a deadline. This leads to wasting any contingency built into individual task duration estimates.
- 8  $EAC = ETC \text{ (Estimate to Complete)} + ACWP \text{ (Actual Cost of Work Performed)}$   
where:  $ETC = \frac{BAC \text{ (Budget at Completion)} - BCWP \text{ (Budgeted Cost of Work Performed)}}{CPI}$   
and  $CPI = \frac{BCWP \text{ (Budgeted Cost of Work Performed)}}{ACWP \text{ (Actual Cost of Work Performed)}} \times 100$
- 9 'EVA in the UK – 6th Edition', Stephen F R Wake. Steve Wake Projects Ltd (2003) at pp.23-24. Steve Wake is the chairman of the board of the Association For Project Management and a member of the Planning, Monitoring and Control SIG.
- 10 'A novel multiple linear regression model for forecasting S-curves'. Karl Blyth & Ammar Kaka. Engineering, Construction and Architectural Management, 13,1, pp.82-95 (2006) at p.83-84. References in the text have been removed to ease legibility.
- 11 Typically quantity surveyors in the UK construction industry.
- 12 Simple linear regression can be calculated 'long-hand' (for instance see [http://en.wikipedia.org/wiki/Simple\\_linear\\_regression](http://en.wikipedia.org/wiki/Simple_linear_regression)) but spreadsheets such as Microsoft Excel allow trend lines to be formatted for data including the trend line equation and R2 value.
- 13 'The Analysis of Time Series: An Introduction, Sixth Edition', Chris Chatfield. Chapman and Hall/CRC, (2003).

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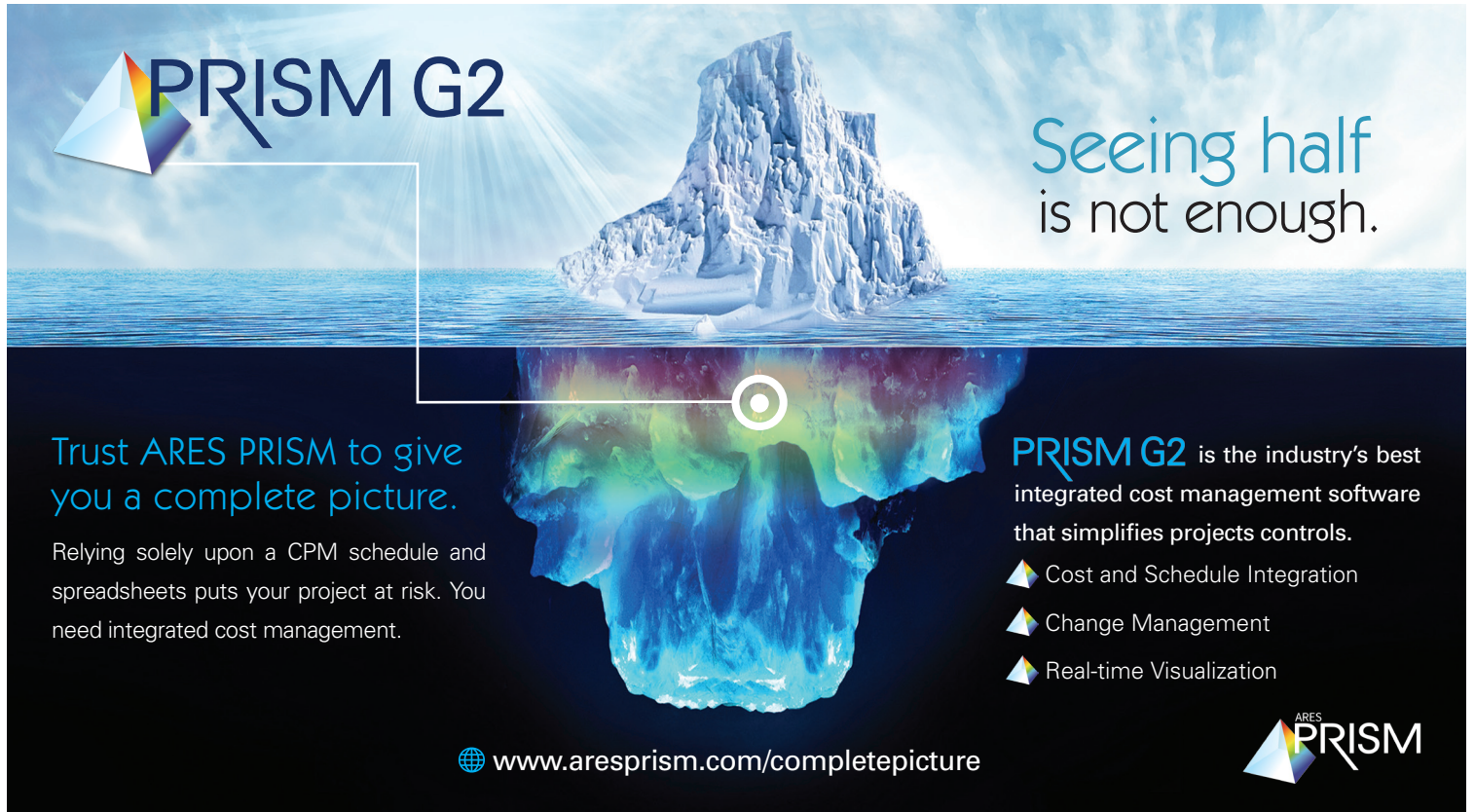
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